KENDRION

EtherCAT®

CANopen®

Kuhnke FIO I/O System

Product Manual: Analogue I/O Modules

12/03/2024

PRECISION. SAFETY. MOTION.

Table of Contents

1 Preface

1.1 Legal Notice

Contact Details

Kendrion Kuhnke Automation GmbH
Industrial Control Systems
Lütjenburger Str. 101
D-23714 Malente
Germany

Support (phone)	+49 4523 402-300
Support (email)	controltechnology-ics@kendrion.com
Switchboard	+49 4523 402-0
Sales (email)	sales-ics@kendrion.com
Internet	www.kendrion.com

Document History

Modification History

Date	Comments / Modifications
12.03.2024	New document structure created according to module groups

1.2 About this Manual

This technical information is primarily directed to system designers, project engineers and device developers. It does not contain any availability information. We reserve the rights for errors, omissions and modifications. Pictures are similar.

This product manual extends the system, installation and safe handling information provided by the Kuhnke FIO System Manual. This product manual only applies in conjunction with the system manual.

2 Analogue I/O Modules

2.1 Generalities

The range of analogue I/O modules comprises all Kuhnke FIO modules equipped with just analogue inputs, outputs or both inputs and outputs.

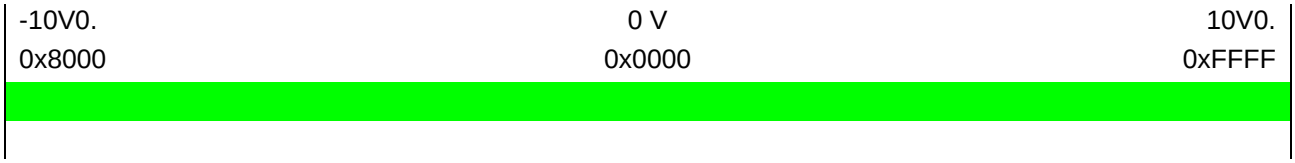
2.1.1 Representation of Analogue Values:

Range 0 … 20mA

Range 4 … 20mA

Range 0 … 10V

Range -10 … +10V



2.1.2 Numeric Values

As a general rule, numeric values are shown as decimals.
A prefixed 0x marks hexadecimal values (example: 0xFFFF).
A prefixed 0b marks binary values (example: 0b01010011).
Objects from the object dictionary generally show as hexadecimal value.

2.1.3 CoE – CANopen over EtherCAT

Communication protocol CANopen is based on CAN and designed to interconnect automation devices. Communication profiles for various device classes harmonise device operations and simplify their handling.

EtherCAT features the same communication mechanisms as CANopen, i.e. an **object dictionary**, **process data objects (PDOs)** and **service data objects (SDOs)**, and a similar network management methodology.

The **object dictionary** describes the object available to the EtherCAT slave. It distinguishes between objects with read access (read), write access (write) and read/write access (read/write). The dictionary also classifies these objects as (mappable) process data objects, if so.

A cyclic process exchanges the **process data objects (PDOs)** and the input and output data they normally carry. Depending on your EtherCAT slave, you may be able to add (map) further object dictionary variables.

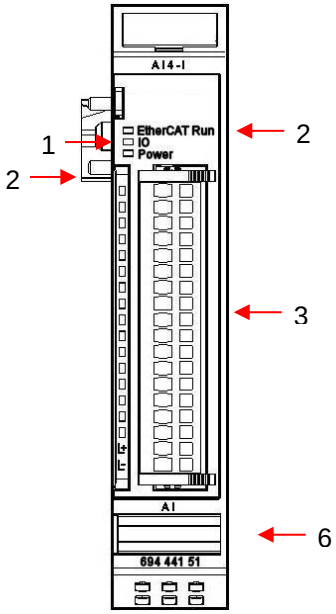
Service data objects (SDOs) provide options like setting the parameters of EtherCAT slaves and adding them to the startup parameters. They will then be automatically transferred to the EtherCAT slave as the EtherCAT bus starts up. Setting up the parameters is as easy as that. And if you have to replace your EtherCAT slave, you can simply use another EtherCAT slave of the same type.

2.2 FIO AI4-I (CoE)

2.2.1 Function

The AI4-I module has 4 analogue current signal inputs. Their measuring range can be set separately for every channel, i.e. either to 0..20mA or to 4..20mA.

2.2.2 Front View



Key

1. Status LEDs
2. E-Bus / module lock
3. 36-pin system connector
4. Earth/shield connector for M3x5 bolts

2.2.3 Connectors

Power Supply to Module I/Os

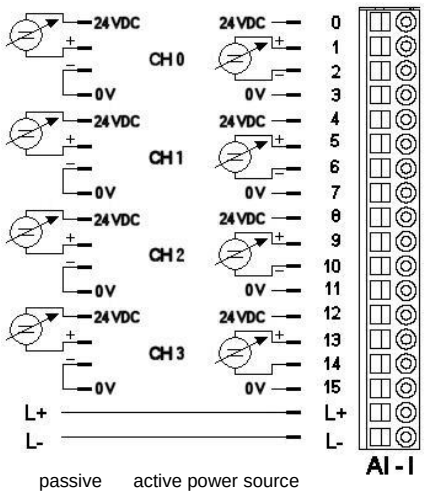
System connector pin 16: L+ 24 VDC
System connector pin 17: L- 0 V

Analogue Inputs

System connector pins 0 … 15

EtherCAT

E-Bus IN female 10-pole connector
E-Bus Out 10-pole multi-pin connector



2.2.4 Status LEDs

LED "EtherCAT Run":

State	LED flash code	Explanation
Init	Off	Initialising, no data exchange
Pre-Op	Off/green, 1:1	Pre-operational, no data exchange
Safe-Op	Off/green, 5:1	Safe operation, inputs readable
Op	Green, on	Operational, unrestricted data exchange
Bootstrap	Flickering	Optional if the bootstrap mode is supported.

LED "IO"

State	LED flash code	Explanation
Ok	Green	No error
Error	Off	LED "EtherCAT Run" off: n/a LED "EtherCAT Run" green: Module defective
	Red, 4x	Bus error
	Red, 7x	Configuration error
	Red, on	Module defective

LED "Power"

State	LED	Explanation
On	Green	24 VDC supply to I/Os (load) ok
Off	Off	24 VDC supply not ok

LED "Channel"

State	LED flash code	Explanation
On	Green	Channel enabled
Off	Off	Channel disabled
Added error codes of the CoE variant (694 441 51 Kuhnke FIO AI4-I 12-Bit)		
Error	Red, 1x	Current > 20.5 mA
	Red, 2x	Configuration 4..20mA: Broken wire (current < 3.5mA)

2.2.5 Process Data Objects

Variable	Data type	Explanation
ControlWord	WORD	Bit 0: ↑ Reset Error

Variable	Data type	Explanation
StateWord	DWORD	Module state bits

Bit	Name	Explanation
0	ResetErrorAck	Acknowledges "Reset Error" in Module Control
1	Undervoltage24	Power to passive sensors < 19 V (no error, just info)
2	EtherCATError	Sync Manager Watchdog
3	ConfigError	Mismatch of Sync Manager's quantity structure
4-7		not used
8	Input0low	Current at 4-20mA < 3.5mA
9	Input1low	Current at 4-20mA < 3.5mA
10	Input2low	Current at 4-20mA < 3.5mA
11	Input3low	Current at 4-20mA < 3.5mA
12-15		not used
16	Input0high	Current > 20.5 mA
17	Input1high	Current > 20.5 mA
18	Input2high	Current > 20.5 mA
19	Input3high	Current > 20.5 mA
20-31	-	not used

Variable	Data type	Explanation
Input0	INT	Analogue input value of channel 0
Input1	INT	Analogue input value of channel 1
Input2	INT	Analogue input value of channel 2
Input3	INT	Analogue input value of channel 3

2.2.6 Module Configuration

Service data objects (SDOs) are used to configure the module. Most EtherCAT configurators support SDOs as additional startup parameters. They ensure that the parameters are transferred to the module every time the EtherCAT master starts up.

Channel Properties

Index	Name	Type	Default	Admissible Values	Access
2000	Analogue Input Properties	Array			
2000, <n> n=1…4	Input <m> m=0…3	UINT8	Off	Off (0), 4-20mA (5), 0-20mA (6)	RW

Averaging

Index	Name	Type	Default	Admissible Values	Access
2003	Input average	Array			
2003, <n> n=1…3	Input <m> average m=0…3	UINT8	1	1..255	RW

2.2.7 EtherCAT Configuration

The module supports two op modes

Mode: Synchronous Syncmanager

The cycling EtherCAT frame triggers data exchange with the bus.

Mode: Distributed Clocks

All EtherCAT network stations should use synchronised clocks, if they are to capture and output data at the same point in time. This is achieved by a local clock in every EtherCAT slave controller that the EtherCAT master automatically synchronises with the EtherCAT network's master clock.

The EtherCAT slave controllers residing in the EtherCAT network generate synchronous interrupts which simultaneously capture input data and/or process output data.

2.2.8 Object Dictionary

Index	Name	Type	Default	Admissible Values	Access
1000	Device Type	UINT32	0x40191		RO
1001	Error Register	UINT8			RO
1008	Device Name	String	AI4-I 12-Bit		RO
1009	Hardware Version	String	1.00		RO
100A	Software Version	String	1.00		RO
1018	Identity Object	Array			
1018, 0	Number of Entries	UINT8	4		RO
1018, 1	Vendor Id	UINT32	0x0048554B		RO
1018, 2	Product Code	UINT32	185339		RO
1018, 3	Revision Number	UINT32	1		RO
1018, 4	Serial Number	UINT32			RO
2000	Analogue Input Properties	Array			
2000, 0	Number of Entries	UINT8	4		RO
2000, 1	Input 0	UINT8	Off	Off (0), 4-20mA (5), 0-20mA (6)	RW
2000, 2	Input 1	UINT8	Off		RW
2000, 3	Input 2	UINT8	Off		RW
2000, 4	Input 3	UINT8	Off		RW
2003	Input Average	Array			
2003, 0	Number of Entries	UINT8	4		RO
2003, 1	Input 0 Average	UINT8	1	1..255	RW
2003, 2	Input 1 Average	UINT8	1	1..255	RW
2003, 3	Input 2 Average	UINT8	1	1..255	RW
2003, 4	Input 3 Average	UINT8	1	1..255	RW
6401	Analogue Input	Array			
6401, 0	Number of Entries	UINT8	4		RO
6401, 1	Analogue Input 0	UINT16			RO P
6401, 2	Analogue Input 1	UINT16			RO P
6401, 3	Analogue Input 2	UINT16			RO P
6401, 4	Analogue Input 3	UINT16			RO P
6500	StateWord	Array			
6500, 0	Number of Entries	UINT8	32		RO
6500, 1	ResetErrorAck	BOOL			RO P
6500, 2	Undervoltage24	BOOL			RO P
6500, 3	EtherCAT Error	BOOL			RO P
6500, 4	ConfigError	BOOL			RO P
6500, 5..8	-	BOOL			RO P
6500, 9	Input 0 low	BOOL			RO P
6500, 10	Input 1 low	BOOL			RO P
6500, 11	Input 2 low	BOOL			RO P
6500, 12	Input 3 low	BOOL			RO P
6500, 13..16	-	BOOL			RO P
6500, 17	Input 0 high	BOOL			RO P
6500, 18	Input 1 high	BOOL			RO P
6500, 19	Input 2 high	BOOL			RO P
6500, 20	Input 3 high	BOOL			RO P

Index	Name	Type	Default	Admissible Values	Access
6500, 21..32	-	BOOL			RO P
6500, 1	ResetErrorAck	BOOL			RO P
6500, 3	EtherCAT Error	BOOL			RO P
6500, 4	ConfigError	BOOL			RO P
7001	Module Control	Array			
7001, 0	Number of Entries	UINT8	1		RO
7001, 1	Reset Error	BOOL			RW P

RO=read-only, RW= read/write, P=process image

2.2.9 Technical Data

Analogue inputs 4
Measuring range ..... 0 …20mA, 4…20mA (final value: 20mA)
Resolution ..... 12 bit
EtherCAT slave controller ..... ASIC ET1200
E-bus connector ..... 10-pole system plug in side wall
E-bus load ..... 190 mA
I/O / power connection ..... male 18-pin
Power supply ..... 24 VDC (-15% ... +20%)
Electrical insulation ..... 500V E-Bus / power supply
Part no. ..... 694.441.51 (CoE)

Start AD conversion ..... synchronised with DC / SM
Conversion time ..... 235 µs (if all channels are active)
Internal resistance ..... < 300Ω
Input filter cutoff frequency ..... 100 kHz
Measuring error ..... < ±0.5%, typ. < ±0.4% of final value
Sensor power ..... 24VDC, total max. current 200mA

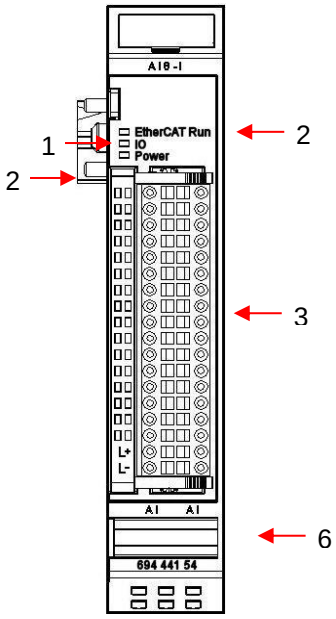
Permits: .....

2.3 FIO AI8-I (CoE)

2.3.1 Function

The AI8-I module has 8 analogue current signal inputs. Their measuring range can be set separately for every channel, i.e. either to 0..20mA or to 4..20mA.

2.3.2 Front View



Key

1. Status LEDs
2. E-Bus / module lock
3. 36-pin system connector
4. Earth/shield connector for M3x5 bolts

2.3.3 Connectors

Power Supply to Module I/Os

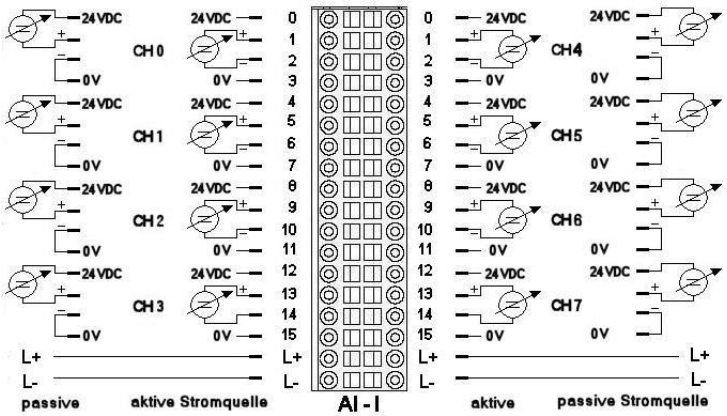
System connector pin 16: L+ 24 VDC
System connector pin 17: L- 0 V

Analogue Inputs

Left row of pins of system connector, pins 0..
Right row of pins of system connector, pins 0

EtherCAT

E-Bus IN female 10-pole connector
E-Bus Out 10-pole multi-pin connector



2.3.4 Status LEDs

LED "EtherCAT Run":

State	LED flash code	Explanation
Init	Off	Initialising, no data exchange
Pre-Op	Off/green, 1:1	Pre-operational, no data exchange
Safe-Op	Off/green, 5:1	Safe operation, inputs readable
Op	Green, on	Operational, unrestricted data exchange
Bootstrap	Flickering	Optional if the bootstrap mode is supported.

LED "IO"

State	LED flash code	Explanation
Ok	Green	No error
Error	Off	LED "EtherCAT Run" off: n/a LED "EtherCAT Run" green: Module defective
	Red, 4x	Bus error
	Red, 7x	Configuration error
	Red, on	Module defective

LED "Power"

State	LED	Explanation
On	Green	24 VDC supply to I/Os (load) ok
Off	Off	24 VDC supply not ok

LED "Channel"

State	LED flash code	Explanation
On	Green	Channel enabled
Off	Off	Channel disabled
Added error codes of the CoE variant (694 441 54 Kuhnke FIO AI8-I 12-Bit)		
Error	Red, 1x	Current > 20.5 mA
	Red, 2x	Configuration 4..20mA: Broken wire (current < 3.5mA)

2.3.5 Process Data Objects

Variable	Data type	Explanation
ControlWord	WORD	Bit 0: ↑ Reset Error

Variable	Data type	Explanation
StateWord	DWORD	Module state bits

Bit	Name	Explanation
0	ResetErrorAck	Acknowledges "Reset Error" in Module Control
1	Undervoltage24	Power to passive sensors < 19 V (no error, just info)
2	EtherCATError	Sync Manager Watchdog
3	ConfigError	Mismatch of Sync Manager's quantity structure
4-7		not used
8	Input0low	Current at 4-20mA < 3.5mA
9	Input1low	Current at 4-20mA < 3.5mA
10	Input2low	Current at 4-20mA < 3.5mA
11	Input3low	Current at 4-20mA < 3.5mA
12	Input4low	Current at 4-20mA < 3.5mA
13	Input5low	Current at 4-20mA < 3.5mA
14	Input6low	Current at 4-20mA < 3.5mA
15	Input7low	Current at 4-20mA < 3.5mA
16	Input0high	Current > 20.5 mA
17	Input1high	Current > 20.5 mA
18	Input2high	Current > 20.5 mA
19	Input3high	Current > 20.5 mA
20	Input4high	Current > 20.5 mA
21	Input5high	Current > 20.5 mA
22	Input6high	Current > 20.5 mA
23	Input7high	Current > 20.5 mA
24-31	-	not used

Variable	Data type	Explanation
Input0	INT	Analogue input value of channel 0
Input1	INT	Analogue input value of channel 1
Input2	INT	Analogue input value of channel 2
Input3	INT	Analogue input value of channel 3
Input4	INT	Analogue input value of channel 4
Input5	INT	Analogue input value of channel 5
Input6	INT	Analogue input value of channel 6
Input7	INT	Analogue input value of channel 7

2.3.6 Module Configuration

Service data objects (SDOs) are used to configure the module. Most EtherCAT configurators support SDOs as additional startup parameters. They ensure that the parameters are transferred to the module every time the EtherCAT master starts up.

Channel Properties

Index	Name	Type	Default	Admissible Values	Access
2000	Analogue Input Properties	Array			
2000, <n> n=1…8	Input <m> m=0…7	UINT8	Off	Off (0), 4-20mA (5), 0-20mA (6)	RW

Averaging

Index	Name	Type	Default	Admissible Values	Access
2003	Input Average	Array			
2003, <n> n=1…8	Input <m> average m=0…7	UINT8	1	1..255	RW

2.3.7 EtherCAT Configuration

The module supports two op modes

Mode: Synchronous Syncmanager

The cycling EtherCAT frame triggers data exchange with the bus.

Mode: Distributed Clocks

All EtherCAT network stations should use synchronised clocks, if they are to capture and output data at the same point in time. This is achieved by a local clock in every EtherCAT slave controller that the EtherCAT master automatically synchronises with the EtherCAT network's master clock.

The EtherCAT slave controllers residing in the EtherCAT network generate synchronous interrupts which simultaneously capture input data and/or process output data.

2.3.8 Object Dictionary

Index	Name	Type	Default	Admissible Values	Access
1000	Device Type	UINT32	0x40191		RO
1001	Error Register	UINT8			RO
1008	Device Name	String	AI8-I 12-Bit		RO
1009	Hardware Version	String	1.00		RO
100A	Software Version	String	1.00		RO
1018	Identity Object	Array			
1018, 0	Number of Entries	UINT8	4		RO
1018, 1	Vendor Id	UINT32	0x0048554B		RO
1018, 2	Product Code	UINT32	185345		RO
1018, 3	Revision Number	UINT32	1		RO
1018, 4	Serial Number	UINT32			RO
2000	Analogue Input Properties	Array			
2000, 0	Number of Entries	UINT8	8		RO
2000, 1	Input 0	UINT8	Off	Off (0), 4-20mA (5), 0-20mA (6)	RW
2000, 2	Input 1	UINT8	Off		RW
2000, 3	Input 2	UINT8	Off		RW
2000, 4	Input 3	UINT8	Off		RW
2000, 5	Input 4	UINT8	Off		RW
2000, 6	Input 5	UINT8	Off		RW
2000, 7	Input 6	UINT8	Off		RW
2000, 8	Input 7	UINT8	Off		RW
2003	Input Average	Array			
2003, 0	Number of Entries	UINT8	8		RO
2003, 1	Input 0 Average	UINT8	1	1..255	RW
2003, 2	Input 1 Average	UINT8	1	1..255	RW
2003, 3	Input 2 Average	UINT8	1	1..255	RW
2003, 4	Input 3 Average	UINT8	1	1..255	RW
2003, 5	Input 4 Average	UINT8	1	1..255	RW
2003, 6	Input 5 Average	UINT8	1	1..255	RW
2003, 7	Input 6 Average	UINT8	1	1..255	RW
2003, 8	Input 7 Average	UINT8	1	1..255	RW
6401	Analogue input	Array			
6401, 0	Number of Entries	UINT8	8		RO
6401, 1	Analogue Input 0	UINT16			RO P
6401, 2	Analogue Input 1	UINT16			RO P
6401, 3	Analogue Input 2	UINT16			RO P
6401, 4	Analogue Input 3	UINT16			RO P
6401, 5	Analogue Input 4	UINT16			RO P
6401, 6	Analogue Input 5	UINT16			RO P
6401, 7	Analogue Input 6	UINT16			RO P
6401, 8	Analogue Input 7	UINT16			RO P
6500	StateWord	Array			
6500, 0	Number of Entries	UINT8	32		RO
6500, 1	ResetErrorAck	BOOL			RO P
6500, 2	Undervoltage24	BOOL			RO P

Index	Name	Type	Default	Admissible Values	Access
6500, 3	EtherCAT Error	BOOL			RO P
6500, 4	ConfigError	BOOL			RO P
6500, 5..8	-	BOOL			RO P
6500, 9	Input 0 low	BOOL			RO P
6500, 10	Input 1 low	BOOL			RO P
6500, 11	Input 2 low	BOOL			RO P
6500, 12	Input 3 low	BOOL			RO P
6500, 13	Input 4 low	BOOL			RO P
6500, 14	Input 5 low	BOOL			RO P
6500, 15	Input 6 low	BOOL			RO P
6500, 16	Input 7 low	BOOL			RO P
6500, 17	Input 0 high	BOOL			RO P
6500, 18	Input 1 high	BOOL			RO P
6500, 19	Input 2 high	BOOL			RO P
6500, 20	Input 3 high	BOOL			RO P
6500, 21	Input 4 high	BOOL			RO P
6500, 22	Input 5 high	BOOL			RO P
6500, 23	Input 6 high	BOOL			RO P
6500, 24	Input 7 high	BOOL			RO P
6500, 25..32	-	BOOL			RO P
6500, 1	ResetErrorAck	BOOL			RO P
6500, 3	EtherCAT Error	BOOL			RO P
6500, 4	ConfigError	BOOL			RO P
7001	Module Control	Array			
7001, 0	Number of Entries	UINT8	1		RO
7001, 1	Reset Error	BOOL			RW P

RO=read-only, RW= read/write, P=process image

2.3.9 Technical Data

Analogue inputs	8
Measuring range	0 …20mA, 4…20mA (final value: 20mA)
Resolution	12 bit
EtherCAT slave controller	ASIC ET1200
E-bus connector	10-pole system plug in side wall
E-bus load	190 mA
I/O / power connection	36-pin male
Power supply	24 VDC (-15% ... +20%)
Electrical insulation	500V E-Bus / power supply
Part no.	694.441.54 (CoE)

Start AD conversion	synchronised with DC / SM
Conversion time	290 µs (if all channels are active)
Internal resistance	< 300Ω
Input filter cutoff frequency	100 kHz
Measuring error	< ±0.5%, typ. < ±0.4% of final value
Sensor power	24VDC, total max. current 200mA

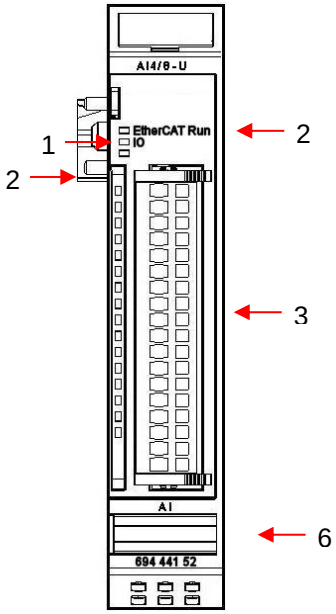
Permits:

2.4 FIO AI4/8-U 13 Bit (CoE)

2.4.1 Function

Depending on its configuration, module AI4/8-U has 4 differential or 8 single-ended analogue inputs for capturing signal voltages between 0 and 10V or -10V and +10V.

2.4.2 Front View



Key

1. Status LEDs
2. E-Bus / module lock
3. 36-pin system connector
4. Earth/shield connector for M3x5 bolts

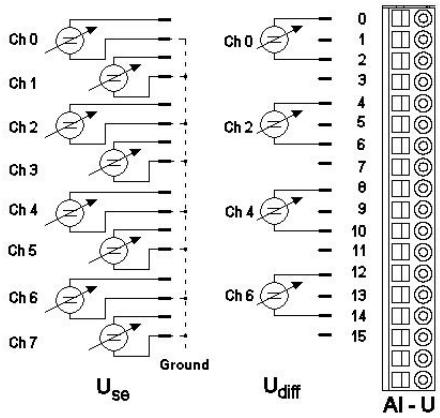
2.4.3 Connectors

Power Supply to Module I/Os

Not necessary, the E-bus supplies power

Analogue Inputs

Left row of pins of system connector, pins 0…15



EtherCAT

E-Bus IN	female 10-pole connector
E-Bus Out	10-pole multi-pin connector

2.4.4 Status LEDs

LED "EtherCAT Run":

State	LED flash code	Explanation
Init	Off	Initialising, no data exchange
Pre-Op	Off/green, 1:1	Pre-operational, no data exchange
Safe-Op	Off/green, 5:1	Safe operation, inputs readable
Op	Green, on	Operational, unrestricted data exchange
Bootstrap	Flickering	Optional if the bootstrap mode is supported.

LED "IO"

State	LED flash code	Explanation
Ok	Green	No error
Error	Off	LED "EtherCAT Run" off: n/a LED "EtherCAT Run" green: Module defective
	Red, 4x	Bus error
	Red, 7x	Configuration error
	Red, on	Module defective

LED "Power"

No

LED "Channel"

State	LED flash code	Explanation
On	Green	Channel enabled
Off	Off	Channel disabled

2.4.5 Process Data Objects

Variable	Data type	Explanation
ControlWord	WORD	Bit 0: ↑ Reset Error

Variable	Data type	Explanation
StateWord	DWORD	Module state bits

Bit	Name	Explanation
0	ResetErrorAck	Acknowledges "Reset Error" in Module Control
1		not used
2	EtherCATError	Sync Manager Watchdog
3	ConfigError	Mismatch of Sync Manager's quantity structure
4-15		not used

Variable	Data type	Explanation
Input0	INT	Analogue input value of channel 0
Input1	INT	Analogue input value of channel 1
Input2	INT	Analogue input value of channel 2
Input3	INT	Analogue input value of channel 3
Input4	INT	Analogue input value of channel 4
Input5	INT	Analogue input value of channel 5
Input6	INT	Analogue input value of channel 6
Input7	INT	Analogue input value of channel 7

2.4.6 Module Configuration

Service data objects (SDOs) are used to configure the module. Most EtherCAT configurators support SDOs as additional startup parameters. They ensure that the parameters are transferred to the module every time the EtherCAT master starts up.

Channel Properties (Signal)

Index	Name	Type	Default	Admissible Values	Access
2000	Analogue Input Properties	Array			
2000, <n> n=1…8	Input <m> m=0…7	UINT8	Off	Off (0), 0-10V (1), +-5V (2) +-10V (3) +-2.5V (4)	RW

Channel Properties (Single-ended / Differential)

Index	Name	Type	Default	Admissible Values	Access
2001	Input Switch	Array			
2001, 0	Number of Entries	UINT8	4		RO
2001, 1	Input 0_1 Switch	UINT8	Single-ended	Single-ended (0) Differential (1)	RW
2001, 2	Input 2_3 Switch	UINT8	Single-ended		RW
2001, 3	Input 4_5 Switch	UINT8	Single-ended		RW
2001, 4	Input 6_7 Switch	UINT8	Single-ended		RW

Averaging

Index	Name	Type	Default	Admissible Values	Access
2003	Input Filter	Array			
2003, <n> n=1…8	Input <m> average m=0…7	UINT8	1	1..255	RW

2.4.7 EtherCAT Configuration

The module supports two op modes

Mode: Synchronous Syncmanager

The cycling EtherCAT frame triggers data exchange with the bus.

Mode: Distributed Clocks

All EtherCAT network stations should use synchronised clocks, if they are to capture and output data at the same point in time. This is achieved by a local clock in every EtherCAT slave controller that the EtherCAT master automatically synchronises with the EtherCAT network's master clock.

The EtherCAT slave controllers residing in the EtherCAT network generate synchronous interrupts which simultaneously capture input data and/or process output data.

2.4.8 Object Dictionary

Index	Name	Type	Default	Admissible Values	Access
1000	Device Type	UINT32	0x40191		RO
1001	Error Register	UINT8			RO
1008	Device Name	String	AI4/8-U 13-Bit		RO
1009	Hardware Version	String	1.00		RO
100A	Software Version	String	1.00		RO
1018	Identity Object	Array			
1018, 0	Number of Entries	UINT8	4		RO
1018, 1	Vendor Id	UINT32	0x0048554B		RO
1018, 2	Product Code	UINT32	185340		RO
1018, 3	Revision Number	UINT32	2		RO
1018, 4	Serial Number	UINT32	0		RO
2000	Analogue Input Properties	Array			
2000, 0	Number of Entries	UINT8	8		RO
2000, 1	Input 0	UINT8	Off	Off (0), 0-10V (1), +-5V (2) +-10V (3) +-2.5V (4)	RW
2000, 2	Input 1	UINT8	Off		RW
2000, 3	Input 2	UINT8	Off		RW
2000, 4	Input 3	UINT8	Off		RW
2000, 5	Input 4	UINT8	Off		RW
2000, 6	Input 5	UINT8	Off		RW
2000, 7	Input 6	UINT8	Off		RW
2000, 8	Input 7	UINT8	Off		RW
2001	Input Switch	Array			
2001, 0	Number of Entries	UINT8	4		RO
2001, 1	Input 0_1 Switch	UINT8	Single-ended	Single-ended (0) Differential (1)	RW
2001, 2	Input 2_3 Switch	UINT8	Single-ended		RW
2001, 3	Input 4_5 Switch	UINT8	Single-ended		RW
2001, 4	Input 6_7 Switch	UINT8	Single-ended		RW
2003	Input Filter	Array			
2003, 0	Number of Entries	UINT8	8		RO
2003, 1	Input 0 Average	UINT8	1	1..255	RW
2003, 2	Input 1 Average	UINT8	1	1..255	RW
2003, 3	Input 2 Average	UINT8	1	1..255	RW
2003, 4	Input 3 Average	UINT8	1	1..255	RW
2003, 5	Input 4 Average	UINT8	1	1..255	RW
2003, 6	Input 5 Average	UINT8	1	1..255	RW
2003, 7	Input 6 Average	UINT8	1	1..255	RW
2003, 8	Input 7 Average	UINT8	1	1..255	RW
6401	Analogue input	Array			
6401, 0	Number of Entries	UINT8	8		RO
6401, 1	Analogue Input 0	UINT16			RO P
6401, 2	Analogue Input 1	UINT16			RO P
6401, 3	Analogue Input 2	UINT16			RO P
6401, 4	Analogue Input 3	UINT16			RO P
6401, 5	Analogue Input 4	UINT16			RO P
6401, 6	Analogue Input 5	UINT16			RO P

Index	Name	Type	Default	Admissible Values	Access
6401, 7	Analogue Input 6	UINT16			RO P
6401, 8	Analogue Input 7	UINT16			RO P
6500	StateWord	Array			
6500, 0	Number of Entries	UINT8	16		RO
6500, 1	ResetErrorAck	BOOL			RO P
6500, 3	EtherCAT Error	BOOL			RO P
6500, 4	ConfigError	BOOL			RO P
7001	Module Control	Array			
7001, 0	Number of Entries	UINT8	1		RO
7001, 1	Reset Error	BOOL			RW P

RO=read-only, RW= read/write, P=process image

2.4.9 Technical Data

Analogue inputs	8 single-ended or 4 differential
Measuring range	0 …10V, ± 5V, ± 10V, ± 2,5V
Resolution	13 bit
EtherCAT slave controller	ASIC ET1200
E-bus connector	10-pole system plug in side wall
E-bus load	190 mA
I/O / power connection	male 18-pin
Power supply	24 VDC (-15% ... +20%)
Electrical insulation	500V E-Bus / power supply
Part no.	694.441.52 13-Bit (CoE)

Start AD conversion	synchronised with DC / SM
Conversion time	464 µs (if all channels are active)
Internal resistance	> 1MΩ
Input filter cutoff frequency	typ. 1kHz
Measuring error	< ±0.4%, typ. < ±0.2% of final value

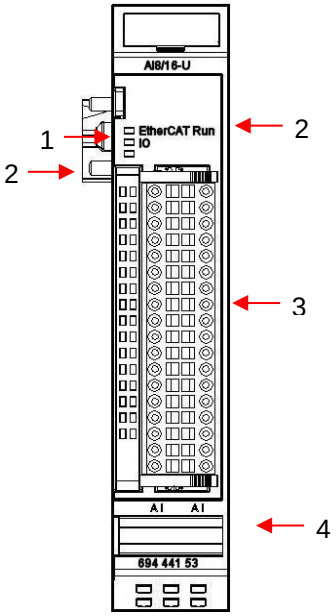
Permits:

2.5 FIO AI8/16-U 13 Bit (CoE)

2.5.1 Function

Depending on its configuration, module AI8/16-U has 8 differential or 16 single-ended analogue inputs for capturing signal voltages between 0 and 10V or -10V and +10V.

2.5.2 Front View



Key

1. Status LEDs
2. E-Bus / module lock
3. 18-pin system connector
4. Earth/shield connector for M3x5 bolts

2.5.3 Connectors

Power Supply to Module I/Os

Not necessary, the E-bus supplies power

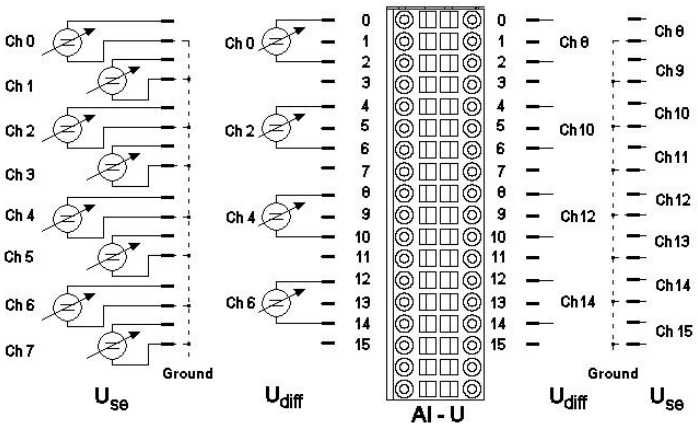
Analogue Inputs

Left row of pins of system connector, pins 0…1

Right row of pins of system connector, pins 0…

EtherCAT

E-Bus IN	female 10-pole connector
E-Bus Out	10-pole multi-pin connector



2.5.4 Status LEDs

LED "EtherCAT Run":

State	LED flash code	Explanation
Init	Off	Initialising, no data exchange
Pre-Op	Off/green, 1:1	Pre-operational, no data exchange
Safe-Op	Off/green, 5:1	Safe operation, inputs readable
Op	Green, on	Operational, unrestricted data exchange
Bootstrap	Flickering	Optional if the bootstrap mode is supported.

LED "IO"

State	LED flash code	Explanation
Ok	Green	No error
Error	Off	LED "EtherCAT Run" off: n/a LED "EtherCAT Run" green: Module defective
	Red, 4x	Bus error
	Red, 7x	Configuration error
	Red, on	Module defective

LED "Power"

No

LED "Channel"

State	LED flash code	Explanation
On	Green	Channel enabled
Off	Off	Channel disabled

2.5.5 Process Data Objects

Variable	Data type	Explanation
ControlWord	WORD	Bit 0: ↑ Reset Error

Variable	Data type	Explanation
StateWord	DWORD	Module state bits

Bit	Name	Explanation
0	ResetErrorAck	Acknowledges "Reset Error" in Module Control
1		not used
2	EtherCATError	Sync Manager Watchdog
3	ConfigError	Mismatch of Sync Manager's quantity structure
4-15		not used

2.5.6 Module Configuration

Service data objects (SDOs) are used to configure the module. Most EtherCAT configurators support SDOs as additional startup parameters. They ensure that the parameters are transferred to the module every time the EtherCAT master starts up.

Channel Properties (Signal)

Index, Subindex	Name	Type	Default	Admissible Values	Access
2000	Analogue Input Properties	Array			
2000, <n> n=1..16	Input <m> m=0 … 15	UINT8	Off	Off (0), 0-10V (1), +-5V (2) +-10V (3) +-2.5V (4)	RW

Channel Properties (Single-ended / Differential)

Index	Name	Type	Default	Admissible Values	Access
2001	Input Switch	Array			
2001	Number of Entries	UINT8	8		RO
2001, 1	Input 0_1 Switch	UINT8	Single-ended	Single-ended (0) Differential (1)	RW
2001, 2	Input 2_3 Switch	UINT8	Single-ended		RW
2001, 3	Input 4_5 Switch	UINT8	Single-ended		RW
2001, 4	Input 6_7 Switch	UINT8	Single-ended		RW
2001, 5	Input 8_9 Switch	UINT8	Single-ended		RW
2001, 6	Input 10_11 Switch	UINT8	Single-ended		RW
2001, 7	Input 12_13 Switch	UINT8	Single-ended		RW
2001, 8	Input 14_15 Switch	UINT8	Single-ended		RW

Averaging

Index, Subindex	Name	Type	Default	Admissible Values	Access
2003	Input Average	Array			
2003, <n> n=1…16	Input <m> average m=0…15	UINT8	1	1..255	RW

2.5.7 EtherCAT Configuration

The module supports two op modes

Mode: Synchronous Syncmanager

The cycling EtherCAT frame triggers data exchange with the bus.

Mode: Distributed Clocks

All EtherCAT network stations should use synchronised clocks, if they are to capture and output data at the same point in time. This is achieved by a local clock in every EtherCAT slave controller that the EtherCAT master automatically synchronises with the EtherCAT network's master clock.

The EtherCAT slave controllers residing in the EtherCAT network generate synchronous interrupts which simultaneously capture input data and/or process output data.

2.5.8 Object Dictionary

Index	Name	Type	Default	Min Max	Access
1000	Device Type	UINT32	0x40191		RO
1001	Error Register	UINT8			RO
1008	Device Name	String	AI8/16-U 13-Bit		RO
1009	Hardware Version	String	1.00		RO
100A	Software Version	String	1.00		RO
1018	Identity Object	Array			
1018, 0	Number of Entries	UINT8	4		RO
1018, 1	Vendor Id	UINT32	0x0048554B		RO
1018, 2	Product Code	UINT32	185341		RO
1018, 3	Revision Number	UINT32	2		RO
1018, 4	Serial Number	UINT32	0		RO
2000	Analogue Input Properties	Array			
2000, 0	Number of Entries	UINT8	16		RO
2000, 1	Input 0	UINT8	Off	Off (0), 0-10V (1), +-5V (2) +-10V (3) +-2.5V (4)	RW
2000, 2	Input 1	UINT8	Off		RW
2000, 3	Input 2	UINT8	Off		RW
2000, 4	Input 3	UINT8	Off		RW
2000, 5	Input 4	UINT8	Off		RW
2000, 6	Input 5	UINT8	Off		RW
2000, 7	Input 6	UINT8	Off		RW
2000, 8	Input 7	UINT8	Off		RW
2000, 9	Input 8	UINT8	Off		RW
2000, 10	Input 9	UINT8	Off		RW
2000, 11	Input 10	UINT8	Off		RW
2000, 12	Input 11	UINT8	Off		RW
2000, 13	Input 12	UINT8	Off		RW
2000, 14	Input 13	UINT8	Off		RW
2000, 15	Input 14	UINT8	Off		RW
2000, 16	Input 15	UINT8	Off		RW
2001		Array			
2001	Number of Entries	UINT8	8		RO
2001, 1	Input 0_1 Switch	UINT8	Single-ended	Single-ended (0) Differential (1)	RW
2001, 2	Input 2_3 Switch	UINT8	Single-ended		RW
2001, 3	Input 4_5 Switch	UINT8	Single-ended		RW
2001, 4	Input 6_7 Switch	UINT8	Single-ended		RW
2001, 5	Input 8_9 Switch	UINT8	Single-ended		RW
2001, 6	Input 10_11 Switch	UINT8	Single-ended		RW
2001, 7	Input 12_13 Switch	UINT8	Single-ended		RW
2001, 8	Input 14_15 Switch	UINT8	Single-ended		RW
2003		Array			
2003	Input Average	Array			
2003, 0	Number of Entries	UINT8	16		RO
2003, 1	Input 0 Average	UINT8	1	1..255	RW
2003, 2	Input 1 Average	UINT8	1	1..255	RW
2003, 3	Input 2 Average	UINT8	1	1..255	RW

Index	Name	Type	Default	Min Max	Access
2003, 4	Input 3 Average	UINT8	1	1..255	RW
2003, 5	Input 4 Average	UINT8	1	1..255	RW
2003, 6	Input 5 Average	UINT8	1	1..255	RW
2003, 7	Input 6 Average	UINT8	1	1..255	RW
2003, 8	Input 7 Average	UINT8	1	1..255	RW
2003, 9	Input 8 Average	UINT8	1	1..255	RW
2003, 10	Input 9 Average	UINT8	1	1..255	RW
2003, 11	Input 10 Average	UINT8	1	1..255	RW
2003, 12	Input 11 Average	UINT8	1	1..255	RW
2003, 13	Input 12 Average	UINT8	1	1..255	RW
2003, 14	Input 13 Average	UINT8	1	1..255	RW
2003, 15	Input 14 Average	UINT8	1	1..255	RW
2003, 16	Input 15 Average	UINT8	1	1..255	RW
6401	Analogue input	Array			
6401, 0	Number of Entries	UINT8	16		RO
6401, 1	Analogue Input 0	UINT16			RO P
6401, 2	Analogue Input 1	UINT16			RO P
6401, 3	Analogue Input 2	UINT16			RO P
6401, 4	Analogue Input 3	UINT16			RO P
6401, 5	Analogue Input 4	UINT16			RO P
6401, 6	Analogue Input 5	UINT16			RO P
6401, 7	Analogue Input 6	UINT16			RO P
6401, 8	Analogue Input 7	UINT16			RO P
6401, 9	Analogue Input 8	UINT16			RO P
6401, 10	Analogue Input 9	UINT16			RO P
6401, 11	Analogue Input 10	UINT16			RO P
6401, 12	Analogue Input 11	UINT16			RO P
6401, 13	Analogue Input 12	UINT16			RO P
6401, 14	Analogue Input 13	UINT16			RO P
6401, 15	Analogue Input 14	UINT16			RO P
6401, 16	Analogue Input 15	UINT16			RO P
6500	StateWord	Array			
6500, 0	Number of Entries	UINT8	16		RO
6500, 1	ResetErrorAck	BOOL			RO P
6500, 3	EtherCAT Error	BOOL			RO P
6500, 4	ConfigError	BOOL			RO P
7001	Module Control	Array			
7001, 0	Number of Entries	UINT8	1		RO
7001, 1	Reset Error	BOOL			RW P

RO=read-only, RW= read/write, P=process image

2.5.9 Technical Data

Analogue inputs	16 single-ended or 8 differential
Measuring range	0 …10V, ± 5V, ± 10V, ± 2,5V
Resolution	13 bit
EtherCAT slave controller	ASIC ET1200
E-bus connector	10-pole system plug in side wall
E-bus load	190 mA
I/O / power connection	36-pin male
Power supply	24 VDC (-15% ... +20%)
Electrical insulation	500V E-Bus / power supply
Part no.	694.441.53 13-Bit (CoE)

Start AD conversion	synchronised with DC / SM
Conversion time	580 µs (if all channels are active)
Internal resistance	> 1MΩ
Input filter cutoff frequency	typ. 1kHz
Measuring error	< ±0.4%, typ. < ±0.2% of final value

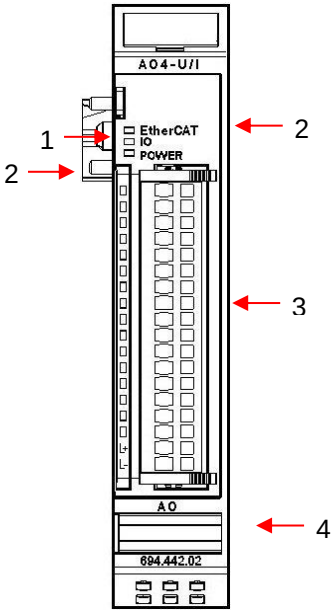
Permits:

2.6 FIO AO4-U/I (CoE)

2.6.1 Function

Module AO4-U/I features 4 analogue outputs. Depending on their configuration, they can output voltages between 0 and 10V or -10V and + 10V or currents between 0 and 20mA or 4 and 20mA.

2.6.2 Front View



Key

1. Status LEDs
2. E-Bus / module lock
3. 18-pin system connector
4. Earth/shield connector for M3x5 bolts

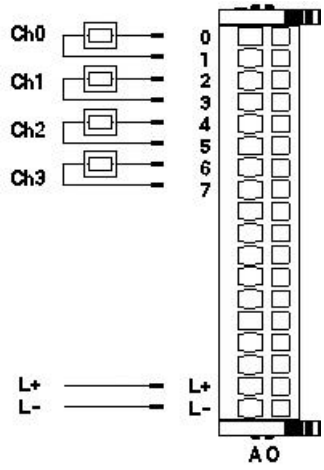
2.6.3 Connectors

Power Supply to Module I/Os

System connector pin 16: L+ 24 VDC
System connector pin 17: L- 0 V

Analogue Outputs

System connector pins 0 … 7



EtherCAT

E-Bus IN female 10-pole connector
E-Bus Out 10-pole multi-pin connector

2.6.4 Status LEDs

LED "EtherCAT Run":

State	LED flash code	Explanation
Init	Off	Initialising, no data exchange
Pre-Op	Off/green, 1:1	Pre-operational, no data exchange
Safe-Op	Off/green, 5:1	Safe operation, inputs readable
Op	Green, on	Operational, unrestricted data exchange
Bootstrap	Flickering	Optional if the bootstrap mode is supported.

LED "IO"

State	LED flash code	Explanation
Ok	Green	No error
Error	Off	LED "EtherCAT Run" off: n/a LED "EtherCAT Run" green: Module defective
	Red, 4x	Bus error
	Red, 7x	Configuration error
	Red, on	Module defective

LED "Power"

State	LED flash code	Explanation
On	Green	24 VDC supply to I/Os (load) ok
Off	Off	24 VDC supply not ok

LED "Channel"

State	LED flash code	Explanation
On	Green, on	Channel enabled
Off	Off	Channel disabled
Error	Red, 1x	Short circuit
	Red, 3x	Wire failure
	Red, 5x	Excessive temp. of output drivers

2.6.5 Module Configuration

Service data objects (SDOs) are used to configure the module. Most EtherCAT configurators support SDOs as additional startup parameters. They ensure that the parameters are transferred to the module every time the EtherCAT master starts up.

Channel Properties (Signal)

Index, Subindex	Name	Type	Default	Admissible Values	Access
2000	Analogue Output Properties	Array			
2000, 1	Properties Output 0	UINT8	0-10V	Off (0), 0-10V (1), +-10V (3), 0-20mA (6), 4-20mA (5), 0-24mA (7)	RW
2000, 2	Properties Output 1	UINT8	0-10V		RW
2000, 3	Properties Output 2	UINT8	0-10V		RW
2000, 4	Properties Output 3	UINT8	0-10V		RW

Channel Properties (Response to Errors)

2001	ErrorBehavior Output 0	Array			
2001, 1	Active on Undervoltage 24	BOOL	FALSE		RW
2001, 1	Active on EtherCAT Watchdog Error	BOOL	FALSE		RW
2002	ErrorBehavior Output 1	Array			
2002, 1	Active on Undervoltage 24	BOOL	FALSE		RW
2002, 1	Active on EtherCAT Watchdog Error	BOOL	FALSE		RW
2003	ErrorBehavior Output 2	Array			
2003, 1	Active on Undervoltage 24	BOOL	FALSE		RW
2003, 1	Active on EtherCAT Watchdog Error	BOOL	FALSE		RW
2004	ErrorBehavior Output 3	Array			
2004, 1	Active on Undervoltage 24	BOOL	FALSE		RW
2004, 1	Active on EtherCAT Watchdog Error	BOOL	FALSE		RW

2.6.6 EtherCAT Configuration

The module supports two op modes

Mode: Synchronous Syncmanager

The cycling EtherCAT frame triggers data exchange with the bus.

Mode: Distributed Clocks

All EtherCAT network stations should use synchronised clocks, if they are to capture and output data at the same point in time. This is achieved by a local clock in every EtherCAT slave controller that the EtherCAT master automatically synchronises with the EtherCAT network's master clock.

The EtherCAT slave controllers residing in the EtherCAT network generate synchronous interrupts which simultaneously capture input data and/or process output data.

2.6.7 Process Data Objects

Variable	Data type	Explanation
ControlWord	WORD	Bit 0: ↑ Reset Error

Variable	Data type	Explanation
StateWord	DWORD	Module state bits

Bit	Name	Explanation
0	ResetErrorAck	Acknowledges "Reset Error" in Module Control
1	Undervoltage24	24V supply low
2	EtherCATError	Sync Manager Watchdog
3	ConfigError	Mismatch of Sync Manager's quantity structure
4	-	
5	-	
6	-	
7	-	
8	Output 0 Overtemp	Over-temperature detected by output driver (automatic switch-off)
9	Output 1 Overtemp	Over-temperature detected by output driver (automatic switch-off)
10	Output 2 Overtemp	Over-temperature detected by output driver (automatic switch-off)
11	Output 3 Overtemp	Over-temperature detected by output driver (automatic switch-off)
12	Output 0 Open	If there is no current in Current mode
13	Output 1 Open	If there is no current in Current mode
14	Output 2 Open	If there is no current in Current mode
15	Output 3 Open	If there is no current in Current mode

Variable	Data type	Explanation
AnalogOutput0	UINT	Analogue output value of channel 0
AnalogOutput1	UINT	Analogue output value of channel 1
AnalogOutput2	UINT	Analogue output value of channel 2
AnalogOutput3	UINT	Analogue output value of channel 3

2.6.8 Object Dictionary

Index	Name	Type	Default	Min Max	Access
1000	Device Type	UINT32	0xF0191		RO
1001	Error Register	UINT8			RO
1008	Device Name	String			RO
1009	Hardware Version	String	1.00		RO
100A	Software Version	String	1.00		RO
1018	Identity Object	Array			
1018, 0	Number of Entries	UINT8	4		RO
1018, 1	Vendor Id	UINT32	0x0048554B		RO
1018, 2	Product Code	UINT32			RO
1018, 3	Revision Number	UINT32	2		RO
1018, 4	Serial Number	UINT32	0		RO
2000	Analogue Output Properties	Array			
2000, 0	Number of Entries	UINT8	4		RO
2000, 1	Properties Output 0	UINT8	0-10V	Off (0), 0-10V (1), +-10V (3), 0-20mA (6), 4-20mA (5), 0-24mA (7)	RW
2000, 2	Properties Output 1	UINT8	0-10V		RW
2000, 3	Properties Output 2	UINT8	0-10V		RW
2000, 4	Properties Output 3	UINT8	0-10V		RW
2001	ErrorBehavior Output 0	Array			
2001, 0	Number of Entries	UINT8	2		RO
2001, 1	Active on Undervoltage 24	BOOL	FALSE		RW
2001, 1	Active on EtherCAT Watchdog Error	BOOL	FALSE		RW
2002	ErrorBehavior Output 1	Array			
2002, 0	Number of Entries	UINT8	2		RO
2002, 1	Active on Undervoltage 24	BOOL	FALSE		RW
2002, 1	Active on EtherCAT Watchdog Error	BOOL	FALSE		RW
2003	ErrorBehavior Output 2	Array			
2003, 0	Number of Entries	UINT8	2		RO
2003, 1	Active on Undervoltage 24	BOOL	FALSE		RW
2003, 1	Active on EtherCAT Watchdog Error	BOOL	FALSE		RW
2004	ErrorBehavior Output 3	Array			
2004, 0	Number of Entries	UINT8	2		RO
2004, 1	Active on Undervoltage 24	BOOL	FALSE		RW
2004, 1	Active on EtherCAT Watchdog Error	BOOL	FALSE		RW
6411	Analogue Outputs	Array			
6411, 0	Number of Entries	UINT8	4		RO
6411, 1	Analogue Output 0	UINT16			RW P
6411, 2	Analogue Output 1	UINT16			RW P
6411, 3	Analogue Output 2	UINT16			RW P
6411, 4	Analogue Output 3	UINT16			RW P
6500	State Word	Array			
6500, 0	Number of Entries	UINT8	16		RO
6500, 1	Reset Error Ack	BOOL			RO P

Index	Name	Type	Default	Min Max	Access
6500, 2	Undervoltage24	BOOL			RO P
6500, 3	EtherCAT Error	BOOL			RO P
6500, 4	ConfigError	BOOL			RO P
6500, 5	-	BOOL			RO P
6500, 6	-	BOOL			RO P
6500, 7	-	BOOL			RO P
6500, 8	-	BOOL			RO P
6500, 9	Output 0 Overtemp	BOOL			RO P
6500, 10	Output 1 Overtemp	BOOL			RO P
6500, 11	Output 2 Overtemp	BOOL			RO P
6500, 12	Output 3 Overtemp	BOOL			RO P
6500, 13	Output 0 Open	BOOL			RO P
6500, 14	Output 1 Open	BOOL			RO P
6500, 15	Output 2 Open	BOOL			RO P
6500, 16	Output 3 Open	BOOL			RO P
7001	Control Word	Array			
7001, 0	Number of Entries	UINT8	1		RO
7001, 1	Reset Error	BOOL			RW P

RO=read-only, RW= read/write, P=process image

2.6.9 Technical Data

Analogue outputs	4
Resolution	16 bit
Output frequency	synchronised with SM/DC
Intrinsic error	±0.2%
Temperature error	±0.005%/K
Destruction limit (external voltages)	15V
EtherCAT slave controller	ASIC ET1200
E-bus connector	10-pole system plug in side wall
E-bus load	150 mA
I/O / power connection	male 18-pin
Power supply	24 VDC (-15% ... +20%)
Electrical insulation	500V E-Bus / power supply
Part no.	694.442.52 16-Bit (CoE)

Voltage:

Measuring range	0 … 10V, ± 10V
Short circuit protection	Yes
Short circuit current	max. 30mA
Load resistance	min. 1kΩ
Settling time	0→10V: ≤22µs at 2kΩ/<200pF

Current:

Measuring range	0…20mA, 4…20mA, 0…24mA
Load resistance	max. 500Ω, max. 1mH (inductive)
Settling time	0→16V: ≤25µs at 300Ω/<1mH

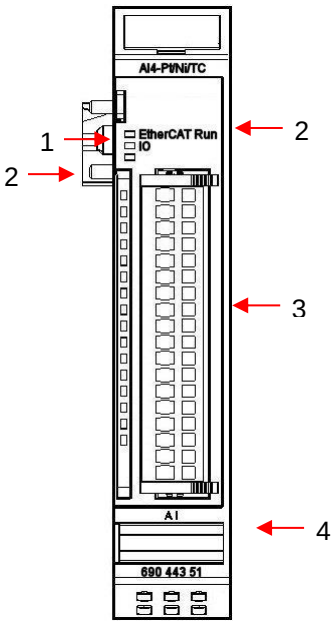
Permits:

2.7 FIO AI4 Pt/Ni/Thermo (CoE)

2.7.1 Function

Module AI4-Pt/Ni/TC features 4 analogue inputs for temperature sensors. Every channel can be separately set to one of the following sensor types: millivolt, Pt100, Pt1000, Ni100, Ni1000 (DIN 43760) or thermocouple.

2.7.2 Front View



Key

1. Status LEDs
2. E-Bus / module lock
3. 36-pin system connector
4. Earth/shield connector for M3x5 bolts

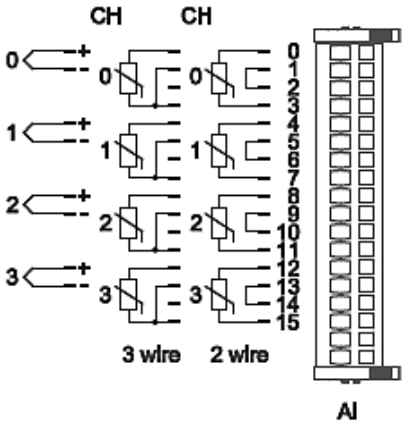
2.7.3 Terminals

Power Supply to Module I/Os

Not required

Analogue Inputs

System connector pins 0 … 15



EtherCAT

E-Bus IN	female 10-pole connector
E-Bus Out	10-pole multi-pin connector

2.7.4 Status LEDs

LED "EtherCAT Run":

State	LED flash code	Explanation
Init	Off	Initialising, no data exchange
Pre-Op	Off/green, 1:1	Pre-operational, no data exchange
Safe-Op	Off/green, 5:1	Safe operation, inputs readable
Op	Green, on	Operational, unrestricted data exchange
Bootstrap	Flickering	Optional if the bootstrap mode is supported.

LED "IO"

State	LED flash code	Explanation
Ok	Green	No error
Error	Off	LED "EtherCAT Run" off: n/a LED "EtherCAT Run" green: Module defective
	Red, 4x	Bus error
	Red, 7x	Configuration error
	Red, on	Module defective

LED "Power"

No

LED "Channel"

State	LED flash code	Explanation
On	Green	Channel enabled
Off	Off	Channel disabled
Error	Red, 1x	Sensor low
	Red, 2x	Sensor high

2.7.5 Process Data Objects

Variable	Data type	Explanation
ControlWord	WORD	Bit 0: ↑ Reset Error

Variable	Data type	Explanation
StateWord	DWORD	Module state bits

Bit	Name	Explanation
0	ResetErrorAck	Acknowledges "Reset Error" in Module Control
1	-	not used
2	EtherCATError	Sync Manager Watchdog
3	ConfigError	Mismatch of Sync Manager's quantity structure
4-7	-	not used
8	Input0low	Incorrect range of connected reading
9	Input1low	Incorrect range of connected reading
10	Input2low	Incorrect range of connected reading
11	Input3low	Incorrect range of connected reading
12-15	-	not used
16	Input0high	Incorrect range of connected reading
17	Input1high	Incorrect range of connected reading
18	Input2high	Incorrect range of connected reading
19	Input3high	Incorrect range of connected reading
20-31	-	not used

Variable	Data type	Explanation
TempInput0	INT	Analogue input value of channel 0
TempInput1	INT	Analogue input value of channel 1
TempInput2	INT	Analogue input value of channel 2
TempInput3	INT	Analogue input value of channel 3

Depending on the configuration, the analogue input value shows as 0.1°C, Ω or 2µV.

2.7.6 Module Configuration

Service data objects (SDOs) are used to configure the module. Most EtherCAT configurators support SDOs as additional startup parameters. They ensure that the parameters are transferred to the module every time the EtherCAT master starts up.

Channel Properties (Signal)

Index, Subindex	Name	Type	Default	Admissible Values	Access
2000	Sensor Type	Array			
2000, <n> n=1…4	Sensor <m> m=0…3	UINT8	Off	Off (0), Internal (1), PT100 (2), PT1000 (3), NI100 (4), NI1000 (5), Thermo_K (6), Thermo_J (7),	RW

Channel Properties (Number Format)

Index, Subindex	Name	Type	Default	Admissible Values	Access
2001	Input Format	Array			
2001, <n> n=1…4	Input<m>Format m=0…3	UINT8	0.1°C	0.1°C (0), Ω / V (1) Raw (2)	RW

Data Transfer Rate and Filter Settings

Index, Subindex	Name	Type	Default	Admissible Values	Access
2002	Data RateAndFilter	Array			
2002, <n> n=1…4	Input<m>DataRateAnd Filter [readings per second] m=0…3	UINT8	20	1000 (0) 600 (1) 330 (2) 175 (3) 90 (4) 45 (5) 20 (6) 20+50&60Hz (7) 20 + 50Hz (8) 20 + 60 Hz (9)	RW

Averaging

Index, Subindex	Name	Type	Default	Admissible Values	Access
2003	Average	Array			

2003, <n> n=1…4	Input <m> average m=0…3	UINT8	1	1..255	RW

2.7.7 EtherCAT Configuration

The module supports two op modes

Mode: Synchronous Syncmanager

The cycling EtherCAT frame triggers data exchange with the bus.

Mode: Distributed Clocks

All EtherCAT network stations should use synchronised clocks, if they are to capture and output data at the same point in time. This is achieved by a local clock in every EtherCAT slave controller that the EtherCAT master automatically synchronises with the EtherCAT network's master clock.

The EtherCAT slave controllers residing in the EtherCAT network generate synchronous interrupts which simultaneously capture input data and/or process output data.

2.7.8 Object Dictionary

Index	Name	Type	Default	Min Max	Access
1000	Device Type	UINT32	0x40191		RO
1001	Error Register	UINT8			RO
1008	Device Name	String	AI4_Pt/Ni/Thermo		RO
1009	Hardware Version	String	1.00		RO
100A	Software Version	String	1.00		RO
1018	Identity Object	Array			
1018, 0	Number of Entries	UINT8	4		RO
1018, 1	Vendor Id	UINT32	0x0048554B		RO
1018, 2	Product Code	UINT32	185345		RO
1018, 3	Revision Number	UINT32	1		RO
1018, 4	Serial Number	UINT32			RO
2000	Sensor Type	Array			
2000, 0	Number of Entries	UINT8	4		RO
2000, 1	Sensor0	UINT8	Off	Off (0), Internal (1), PT100 (2), PT1000 (3), NI100 (4), NI1000 (5), Thermo_K (6), Thermo_J (7),	RW
2000, 2	Sensor1	UINT8	Off		RW
2000, 3	Sensor2	UINT8	Off		RW
2000, 4	Sensor3	UINT8	Off		RW
2001	Input Format	Array			
2001, 0	Number of Entries	UINT8	4		RO
2001, 1	Input0Format	UINT8	0.1°C	0.1°C (0), Ω / V (1) Raw (2)	RW
2001, 2	Input1Format	UINT8	0.1°C		RW
2001, 3	Input2Format	UINT8	0.1°C		RW
2001, 4	Input3Format	UINT8	0.1°C		RW
2002	Data RateAndFilter	Array			
2002, 0	Number of Entries	UINT8	4		
2002, 1	Input0DataRateAnd Filter [readings per second]	UINT8	20	1000 (0) 600 (1) 330 (2) 175 (3) 90 (4) 45 (5) 20 (6) 20+50&60Hz (7) 20 + 50Hz (8) 20 + 60 Hz (9)	RO
2002, 2	Input1DataRateAndFilter [readings per second]	UINT8	20		RO
2002, 3	Input2DataRateAndFilter [readings per second]	UINT8	20		RO
2002, 4	Input3DataRateAndFilter [readings per second]	UINT8	20		RO
2003	Average	Array			
2003, 0	Number of Entries	UINT8	4		RO
2003, 1	Input 0 Average	UINT8	1	1..255	RW
2003, 2	Input 1 Average	UINT8	1	1..255	RW
2003, 3	Input 2 Average	UINT8	1	1..255	RW
2003, 4	Input 3 Average	UINT8	1	1..255	RW

Index	Name	Type	Default	Min Max	Access
6401	Analogue input	Array			
6401, 0	Number of Entries	UINT8	4		RO
6401, 1	Analogue Input 0	UINT16			RO P
6401, 2	Analogue Input 1	UINT16			RO P
6401, 3	Analogue Input 2	UINT16			RO P
6500	StateWord	Array			RO P
6500, 0	Number of Entries	UINT8	32		RO P
6500, 1	ResetErrorAck	BOOL			RO P
6500, 2	-	BOOL			RO P
6500, 3	EtherCAT Error	BOOL			RO P
6500, 4	ConfigError	BOOL			RO P
6500, 5..8	-	BOOL			RO P
6500, 9	Input 0 low	BOOL			RO P
6500, 10	Input 1 low	BOOL			RO P
6500, 11	Input 2 low	BOOL			RO P
6500, 12	Input 3 low	BOOL			RO P
6500, 13..16	-	BOOL			RO P
6500, 17	Input 0 high	BOOL			RO P
6500, 18	Input 1 high	BOOL			RO P
6500, 19	Input 2 high	BOOL			RO P
6500, 20	Input 3 high	BOOL			RO P
6500, 21..32	-	BOOL			RO P
7001	Module Control	Array			
7001, 0	Number of Entries	UINT8	1		RO
7001, 1	Reset Error	BOOL			RW P

RO=read-only, RW= read/write, P=process image

2.7.9 Technical Data

Analogue inputs	4
Resolution	16 bit
Input filter cutoff frequency	typ. 0.33 Hz
Conversion time	50 ms (adjustable)
Measuring error	<±0.54% (of final measuring range value)
Temperature drift	<±50 ppm (of final measuring range value)
EtherCAT slave controller	ASIC ET1200
E-bus connector	10-pole system plug in side wall
E-bus load	170 mA
I/O / power connection	male 18-pin
Power supply	24 VDC (-15% ... +20%)
Electrical insulation	500V E-Bus / power supply
Part no.	694.443.57 (CoE)

Thermocouple

Sensor types	J, K, internal (cold junction)
Cold junction compensation	Yes
Measuring range Type K	-200°C…+1372°C
Measuring range Type J	-50°C…+760°C
Measuring range mV	-40 … +65 mV

Pt100 / Ni100

Measuring range Pt	-75°C…+670°C
Measuring range Ni	-60°C…+250°C
Input resistance	70…320Ω
Measuring current	1mA (typ.)

Pt1000 / Ni1000 DIN43760

Measuring range Pt	-75°C…+670°C
Measuring range Ni	-60°C…+250°C
Input resistance	700…3200Ω
Measuring current	0.1mA (typ.)

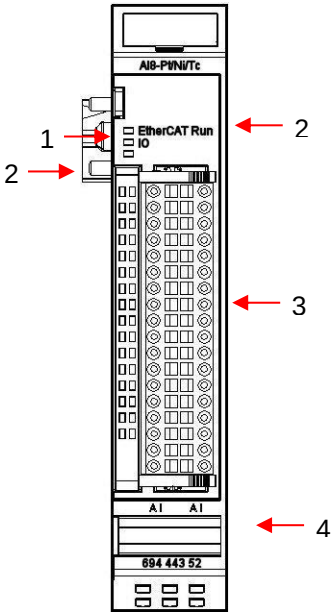
Permits:

2.8 FIO AI8 Pt/Ni/Thermo (CoE)

2.8.1 Function

Module AI8-Pt/Ni/TC features 8 analogue inputs for temperature sensors. Every channel can be separately set to one of the following sensor types: millivolt, Pt100, Pt1000, Ni100, Ni1000 (DIN 43760) or thermocouple.

2.8.2 Front View



Key

1. Status LEDs
2. E-Bus / module lock
3. 36-pin system connector
4. Earth/shield connector for M3x5 bolts

2.8.3 Connectors

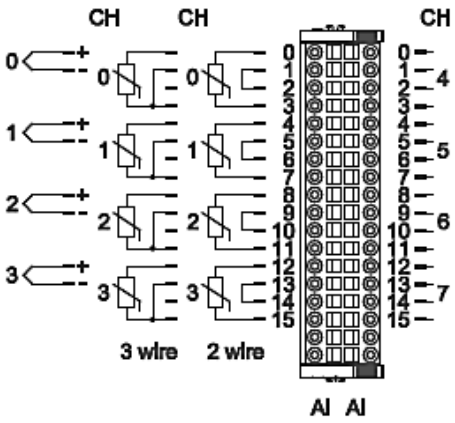
Power Supply to Module I/Os

Not required

Analogue Inputs

Left row of pins of system connector, pins 0…15

Right row of pins of system connector, pins 0…15



EtherCAT

E-Bus IN	female 10-pole connector
E-Bus Out	10-pole multi-pin connector

2.8.4 Status LEDs

LED "EtherCAT Run":

State	LED flash code	Explanation
Init	Off	Initialising, no data exchange
Pre-Op	Off/green, 1:1	Pre-operational, no data exchange
Safe-Op	Off/green, 5:1	Safe operation, inputs readable
Op	Green, on	Operational, unrestricted data exchange
Bootstrap	Flickering	Optional if the bootstrap mode is supported.

LED "IO"

State	LED flash code	Explanation
Ok	Green	No error
Error	Off	LED "EtherCAT Run" off: n/a LED "EtherCAT Run" green: Module defective
	Red, 1x	Short circuit / overload
	Red, 2x	Low voltage
	Red, 4x	Bus error
	Red, 6x	Module-specific fault
	Red, 7x	Configuration error
	Red, on	Module defective

LED "Power"

State	LED flash code	Explanation
On	Green	24 VDC supply to I/Os (load) ok
Off	Off	24 VDC supply not ok

LED "Channel"

State	LED flash code	Explanation
On	Green, on	Channel enabled
Off	Off	Channel disabled
Error	Red, 1x	Short circuit
	Red, 3x	Wire failure
	Red, 5x	Excessive temp. of output drivers

2.8.5 Process Data Objects

2.8.6 Module Configuration

Service data objects (SDOs) are used to configure the module. Most EtherCAT configurators support SDOs as additional startup parameters. They ensure that the parameters are transferred to the module every time the EtherCAT master starts up.

Channel Properties (Signal)

Index, Subindex	Name	Type	Default	Admissible Values	Access
2000	Sensor Type	Array			
2000, <n> n=1…8	Sensor <m> m=0…7	UINT8	Off	Off (0), Internal (1), PT100 (2), PT1000 (3), NI100 (4), NI1000 (5), Thermo_K (6), Thermo_J (7),	RW

Channel Properties (Number Format)

Index, Subindex	Name	Type	Default	Admissible Values	Access
2001	Input Format	Array			
2001, <n> n=1…8	Input<m>Format m=0…7	UINT8	0.1°C	0.1°C (0), Ω / V (1) Raw (2)	RW

Data Transfer Rate and Filter Settings

Index, Subindex	Name	Type	Default	Admissible Values	Access
2002	Data RateAndFilter	Array			
2002, <n> n=1…8	Input<m>DataRateAnd Filter [readings per second] m=0…7	UINT8	20	1000 (0) 600 (1) 330 (2) 175 (3) 90 (4) 45 (5) 20 (6) 20+50&60Hz (7) 20 + 50Hz (8) 20 + 60 Hz (9)	RO

Averaging

Index, Subindex	Name	Type	Default	Admissible Values	Access
2003	Average	Array			

2003, <n> n=1…8	Input <m> average m=0…7	UINT8	1	1..255	RW

2.8.7 EtherCAT Configuration

The module supports two op modes

Mode: Synchronous Syncmanager

The cycling EtherCAT frame triggers data exchange with the bus.

Mode: Distributed Clocks

All EtherCAT network stations should use synchronised clocks, if they are to capture and output data at the same point in time. This is achieved by a local clock in every EtherCAT slave controller that the EtherCAT master automatically synchronises with the EtherCAT network's master clock.

The EtherCAT slave controllers residing in the EtherCAT network generate synchronous interrupts which simultaneously capture input data and/or process output data.

2.8.8 Object Dictionary

Index	Name	Type	Default	Min Max	Access
1000	Device Type	UINT32	0x40191		RO
1001	Error Register	UINT8			RO
1008	Device Name	String	AI8_Pt/Ni/Thermo		RO
1009	Hardware Version	String	1.00		RO
100A	Software Version	String	1.00		RO
1018	Identity Object	Array			
1018, 0	Number of Entries	UINT8	4		RO
1018, 1	Vendor Id	UINT32	0x0048554B		RO
1018, 2	Product Code	UINT32	185346		RO
1018, 3	Revision Number	UINT32	1		RO
1018, 4	Serial Number	UINT32			RO
2000	Sensor Type	Array			
2000, 0	Number of Entries	UINT8	8		RO
2000, 1	Sensor0	UINT8	Off	Off (0), Internal (1), PT100 (2), PT1000 (3), NI100 (4), NI1000 (5), Thermo_K (6), Thermo_J (7),	RW
2000, 2	Sensor1	UINT8	Off		RW
2000, 3	Sensor2	UINT8	Off		RW
2000, 4	Sensor3	UINT8	Off		RW
2000, 5	Sensor4	UINT8	Off		RW
2000, 6	Sensor5	UINT8	Off		RW
2000, 7	Sensor6	UINT8	Off		RW
2000, 8	Sensor7	UINT8	Off		RW
2001	Input Format	Array			
2001, 0	Number of Entries	UINT8	8		RO
2001, 1	Input0Format	UINT8	0.1°C	0.1°C (0), Ω / V (1) Raw (2)	RW
2001, 2	Input1Format	UINT8	0.1°C		RW
2001, 3	Input2Format	UINT8	0.1°C		RW
2001, 4	Input3Format	UINT8	0.1°C		RW
2001, 5	Input4Format	UINT8	0.1°C		RW
2001, 6	Input5Format	UINT8	0.1°C		RW
2001, 7	Input6Format	UINT8	0.1°C		RW
2001, 8	Input Format	UINT8	0.1°C		RW
2002	Data RateAndFilter	Array			
2002, 0	Number of Entries	UINT8	8		
2002, 1	Input0DataRateAndFilter [readings per second]	UINT8	20	1000 (0) 600 (1) 330 (2) 175 (3) 90 (4) 45 PLC (5) 20 PLC (6) 20 PLC+50&60Hz (7) 20 PLC + 50Hz (8) 20 PLC + 60Hz (9)	RO
2002, 2	Input1DataRateAndFilter [readings per second]	UINT8	20		RO
2002, 3	Input2DataRateAndFilter [readings per second]	UINT8	20		RO
2002, 4	Input3DataRateAndFilter [readings per second]	UINT8	20		RO
2002, 5	Input4DataRateAndFilter [readings per second]	UINT8	20		RO
2002, 6	Input5DataRateAnd Filter [readings per second]	UINT8	20		RO

Index	Name	Type	Default	Min Max	Access
2002, 7	Input6DataRateAndFilter [readings per second]	UINT8	20		RO
2002, 8	Input7DataRateandFilter [readings per second]	UINT8	20		RO
2003	Average	Array			
2003, 0	Number of Entries	UINT8	8		RO
2003, 1	Input 0 Average	UINT8	1	1..255	RW
2003, 2	Input 1 Average	UINT8	1	1..255	RW
2003, 3	Input 2 Average	UINT8	1	1..255	RW
2003, 4	Input 3 Average	UINT8	1	1..255	RW
2003, 5	Input 4 Average	UINT8	1	1..255	RW
2003, 6	Input 5 Average	UINT8	1	1..255	RW
2003, 7	Input 6 Average	UINT8	1	1..255	RW
2003, 8	Input 7 Average	UINT8	1	1..255	RW
6401	Analogue input	Array			
6401, 0	Number of Entries	UINT8	8		RO
6401, 1	Analogue Input 0	UINT16			RO P
6401, 2	Analogue Input 1	UINT16			RO P
6401, 3	Analogue Input 2	UINT16			RO P
6401, 4	Analogue Input 3	UINT16			RO P
6401, 5	Analogue Input 4	UINT16			RO P
6401, 6	Analogue Input 5	UINT16			RO P
6401, 7	Analogue Input 6	UINT16			RO P
6401, 8	Analogue Input 7	UINT16			RO P
6500	StateWord	Array			
6500, 0	Number of Entries	UINT8	32		RO
6500, 1	ResetErrorAck	BOOL			RO P
6500, 2	-	BOOL			RO P
6500, 3	EtherCAT Error	BOOL			RO P
6500, 4	ConfigError	BOOL			RO P
6500, 5...8	-	BOOL			RO P
6500, 9	Input 0 low	BOOL			RO P
6500, 10	Input 1 low	BOOL			RO P
6500, 11	Input 2 low	BOOL			RO P
6500, 12	Input 3 low	BOOL			RO P
6500, 13	Input 4 low	BOOL			RO P
6500, 14	Input 5 low	BOOL			RO P
6500, 15	Input 6 low	BOOL			RO P
6500, 16	Input 7 low	BOOL			RO P
6500, 17	Input 0 high	BOOL			RO P
6500, 18	Input 1 high	BOOL			RO P
6500, 19	Input 2 high	BOOL			RO P
6500, 20	Input 3 high	BOOL			RO P
6500, 21	Input 4 high	BOOL			RO P
6500, 22	Input 5 high	BOOL			RO P
6500, 23	Input 6 high	BOOL			RO P
6500, 24	Input 7 high	BOOL			RO P

Index	Name	Type	Default	Min Max	Access
6500, 25..32	ResetErrorAck	BOOL			RO P
6500, 1	EtherCAT Error	BOOL			RO P
6500, 3	ConfigError	BOOL			RO P
6500, 4	Module Control	Array			
7001	Number of Entries	UINT8	1		RO
7001, 0	Reset Error	BOOL			RW P
7001, 1					

RO=read-only, RW= read/write, P=process image

2.8.9 Technical Data

Analogue inputs	8
Resolution	16 bit
Input filter cutoff frequency	typ. 0.33 Hz
Conversion time	50 ms (adjustable)
Measuring error	<±0.54% (of final measuring range value)
Temperature drift	<±50 ppm (of final measuring range value)
EtherCAT slave controller	ASIC ET1200
E-bus connector	10-pole system plug in side wall
E-bus load	170 mA
I/O / power connection	male 36-pin
Power supply	None
Electrical insulation	500V E-Bus / power supply
Part no.	694.443.58 (CoE)

Thermocouple

Sensor types	J, K, internal (cold junction)
Cold point compensation	Yes
Measuring range Type K	-200°C…+1372°C
Measuring range Type J	-50°C…+760°C
Measuring range mV	-40 … +65 mV

Pt100 / Ni100

Measuring range Pt	-75°C…+670°C
Measuring range Ni	-60°C…+250°C
Input resistance	70…320Ω
Measuring current	1mA (typ.)

Pt1000 / Ni1000 DIN43760

Measuring range Pt	-75°C…+670°C
Measuring range Ni	-60°C…+250°C
Input resistance	700…3200Ω
Measuring current	0.1mA (typ.)

Permits:

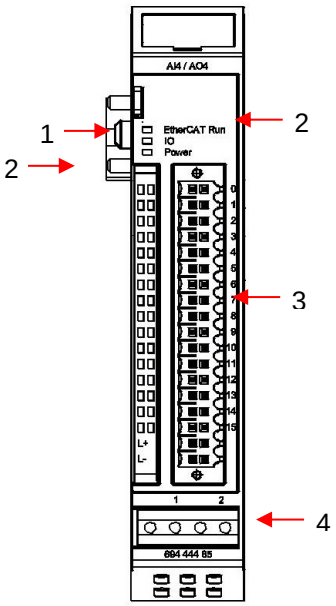
2.9 FIO AI4 12 Bit / AO4 16 Bit (CoE)

2.9.1 Function

Module AI4 12Bit / AO4 16Bit features 4 analogue inputs and 4 analogue outputs. All channels configure almost independently, giving the module a maximum of flexibility.

Input and output values simply scale according to what they will be used for. A measured sensor value, for example, may display as the required unit of measurement.

2.9.2 Front View



Key

1. Status LEDs
2. E-Bus / module lock
3. 36-pin system connector
4. Earth/shield connector for M3x5 bolts

2.9.3 Connectors

Power Supply to Module I/Os

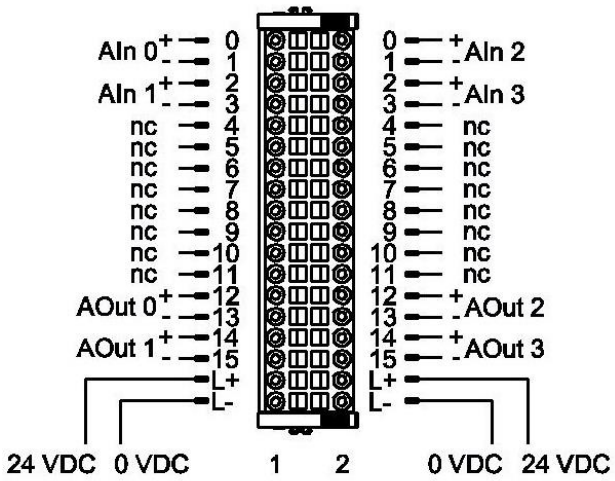
System connector pin 16: L+ 24 VDC
System connector pin 17: L- 0 V

Analogue Inputs

Left row of pins of system connector, pins 0…3
Right row of pins of system connector, pins 0…3

Analogue Outputs

Left row of pins of system connector, pins 12…15
Right row of pins of system connector, pins 12…15



EtherCAT

E-Bus IN female 10-pole connector
E-Bus Out 10-pole multi-pin connector

2.9.4 Status LEDs

LED "EtherCAT Run":

State	LED flash code	Explanation
Init	Off	Initialising, no data exchange
Pre-Op	Off/green, 1:1	Pre-operational, no data exchange
Safe-Op	Off/green, 5:1	Safe operation, inputs readable
Op	Green, on	Operational, unrestricted data exchange
Bootstrap	Flickering	Optional if the bootstrap mode is supported.

LED "IO"

State	LED flash code	Explanation
Ok	Green	No error
Error	Off	LED "EtherCAT Run" off: n/a LED "EtherCAT Run" green: Module defective
	Red, 1x	Short circuit / overload
	Red, 2x	Low voltage
	Red, 4x	Bus error
	Red, 6x	Module-specific fault
	Red, 7x	Configuration error
	red	Module defective

LED "Power"

State	LED	Explanation
On	Green	24 VDC supply to I/Os (load) ok
Off	Off	24 VDC supply not ok

LED "Channel"

State	LED flash code	Explanation
On	Green	Channel enabled
Off	Off	Channel disabled
Error	Red, 1x	Short circuit
	Red, 3x	Wire failure
	Red, 5x	Excessive temp. of output drivers

2.9.5 Module Configuration

Channel Properties of Analogue Inputs (Signal)

Index, Subindex	Name	Type	Default	Admissible Values	Access
6110	AISensorType	Array			
6110, 1	AI sensor type 0	UINT8	0-10V	0-10V (42) 0-20mA (52) 4-20mA (51)	RW
6110, 2	AI sensor type 1	UINT8	0-10V		RW
6110, 3	AI sensor type 2	UINT8	0-10V		RW
6110, 4	AI sensor type 3	UINT8	0-10V		RW

Channel Properties of Analogue Inputs (Scaling)

Input values of a channel scale by adding two control points or a factor and an offset.

Scaled input values transform into a process value (PV) and output to an object mapped separately, i.e. 0x6130 AI Input PV <n>.

Index, Subindex	Name	Type	Default	Admissible Values	Access
2001	AIChannelControl	Array			
2001, 1	Channel Control AI0	UINT8	0	0 1	RW
2001, 2	Channel Control AI1	UINT8	0		RW
2001, 3	Channel Control AI2	UINT8	0		RW
2001, 4	Channel Control AI3	UINT8	0		RW

- 0= scaled using a factor and an offset
- 1= scaled using control points

Scaled values (Channel Control AI<n> = 0)

- 0x6126 AI Scaling Factor <n> scaling factor [process value / field value]
- 0x6127 AI Scaling Offset <n> scaling offset [process value]

Scaled values (Channel Control AI<n> = 1)

- 0x6120 AI Input Scaling 1 FV <n> control point 1, field value [V] or [mA]
- 0x6121 AI Input Scaling 1 PV <n> control point 1, process value
- 0x6122 AI Input Scaling 2 FV <n> control point 2, field value [V] or [mA]
- 0x6123 AI Input Scaling 2 PV <n> control point 2, process value

Channel Properties of Analogue Outputs (Signal)

Index, Subindex	Name	Type	Default	Admissible Values	Access
6310	AOOutputType	Array			
6310, 1	AO output type 0	UINT8	disabled	Disabled (0) 0-10V (10) +/-10V (11) 0-20mA (20) 4-20mA (21)	RW
6310, 2	AO output type 1	UINT8	Disabled		RW
6310, 3	AO output type 2	UINT8	Disabled		RW
6310, 4	AO output type 3	UINT8	Disabled		RW

Channel Properties of Analogue Outputs (Scaling)

Output values of a channel scale by adding two control points or a factor and an offset.

Scaled output values transform into a process value (PV) and output to an object mapped separately, i.e. 0x6300 AO Output PV <n>.

Index, Subindex	Name	Type	Default	Admissible Values	Access
6313	AOOperatingMode	Array			
6313, 1	AO operating mode 0	UINT8	Off	Off (0) (1) (10) (21)	RW
6313, 2	AO operating mode 1	UINT8	Off		RW
6313, 3	AO operating mode 2	UINT8	Off		RW
6313, 4	AO operating mode 3	UINT8	Off		RW

- 0 = Output not active (output disabled)
- 1 = Output Process Value:
  Object 0x6300 AO Output PV specifies setpoints as process values (PV), if the object is mapped as a process data object.
- 10 = Output Field Value Decimal
  Object 0x6330 AO Output Field Value Physical specifies setpoints as [V] or [mA] values, if the object is mapped as a process data object.
- 21 = Output Field Value Increments
  Object 0x7330 AO Field Value Incr specifies setpoints as increments (UINT), if the object is mapped as a process data object.

Scaled values (AO Operating Mode = 1)

- 0x6320 AO Output Scaling 1 FV <n> control point 1, field value [V] or [mA]
- 0x6321 AO Output Scaling 1 PV <n> control point 1, process value
- 0x6322 AO Output Scaling 2 FV <n> control point 2, field value [V] or [mA]
- 0x6323 AO Output Scaling 2 PV <n> control point 2, process value

2.9.6 EtherCAT Configuration

The module supports two op modes. Depending on the configuration, you can also select various process data maps.

Mode: Synchronous Syncmanager

The cycling EtherCAT frame triggers data exchange with the bus.

Mode: Distributed Clocks

All EtherCAT network stations should use synchronised clocks, if they are to capture and output data at the same point in time. This is achieved by a local clock in every EtherCAT slave controller that the EtherCAT master automatically synchronises with the EtherCAT network's master clock.

The EtherCAT slave controllers residing in the EtherCAT network generate synchronous interrupts which simultaneously capture input data and/or process output data.

Distributed Clocks Mode with n-fold Oversampling

Oversampling mode supports the capturing of up to 5 sensor reading per bus cycle, allowing you to capture rapidly changing sensor readings.

To enable n-fold oversampling, choose one of the DC synchronous modes for your EtherCAT slave and set the factor n, as appropriate.

Process Data Mappings – Analogue Inputs

There are various predefined mappings to choose from, depending on how your analogue inputs are configured.

They represent in one of two different ways:

- Field Value Physical: [V] or [mA] input value as REAL
  Mapping 1A0x01 enabled
- Field Value Increments: Digits input value as UINT
  Mapping 1A0x02 enabled
- Process Value: scaled input value (process value) as REAL
  Mapping 1A0x03 enabled

Process Data Mappings – Analogue Inputs

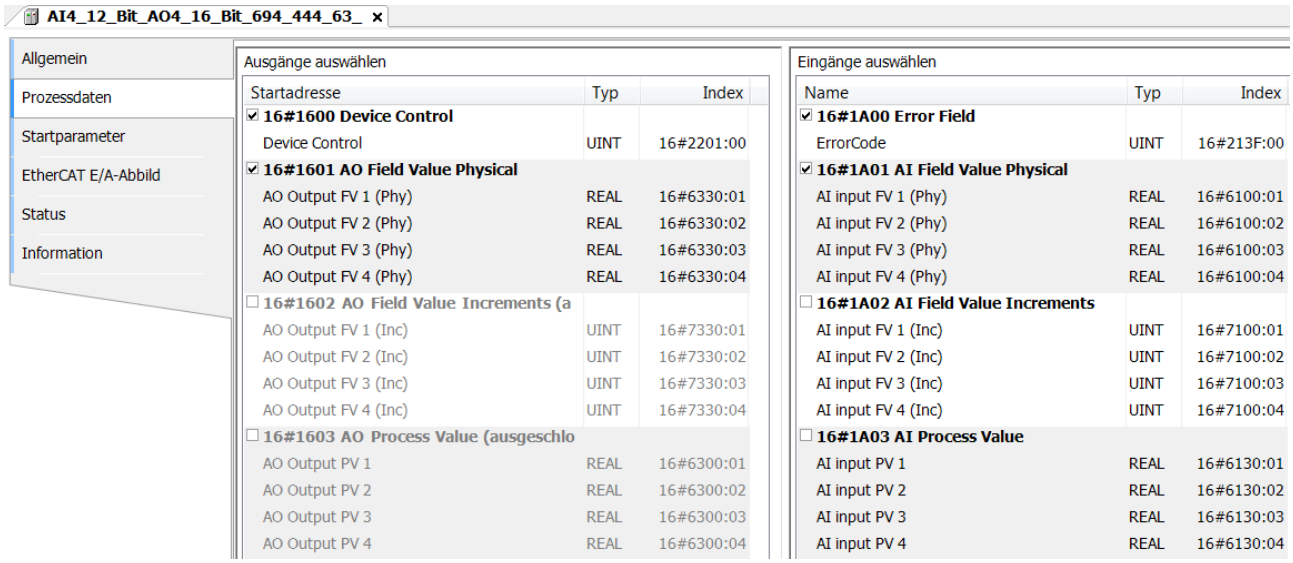
There are various predefined mappings to choose from, depending on how your analogue outputs are configured.

They represent in one of two different ways:

- Field Value Physical: [V] or [mA] output value as REAL
  Mapping 160x01 enabled
- Field Value Increments: Digits output value as UINT
  Mapping 160x02 enabled
- Process Value: scaled output value (process value) as REAL
  Mapping 160x03 enabled

Since the 3 above mappings are mutually exclusive, you can only enable one of them. Check that the mapping you choose matches the "AO operating mode" in the configuration.

View of mapped process data in CODESYS V3's EtherCAT Configurator:



2.9.7 Object Dictionary

Device Type 0x1000

Device type description

Name	Device Type
Index	0x1000
Object Code	VARIABLE
No. of Elements	-
Data Type	UNSIGNED32

Access	read only
PDO Mapping	No
Value Range	Fix
Default Value	0x800A 0192

Additional Information [16] Bit 31…16

Bit 16 = Digital Input FB o
Bit 17 = Analogue Input FB ✓
Bit 18 = Digital Output FB o
Bit 19 = Analogue Output FB ✓
Bit 20 = Controller FB o
Bit 21 = Alarm FB o
Bit 22 = Device FB ✓
Bits 23 to 26 = Specific Function o
Bits 27 to 29 = Reserved o
Bit 30 = Reserved o
Bit 31 = Manufacturer-specific PDO mapping ✓

Device Profile Number [16] bits 15..0

0194h = 404d = 404 Device Profile Number

Error Register 0x1001

Name	Error Register
Index	0x1001
Object Code	VARIABLE
No. of Elements	0
Data Type	UNSIGNED8

Access	read only
PDO Mapping	yes, TX-PDO
Value Range	
Default Value	0

In case of an error, the associated error bit is set. The bit is cleared automatically when the cause of the error has been removed.

7	6	5	4	3	2	1	0
MAN	RES	PROF	COM	TEMP	VOL	CUR	GEN

GEN: general error

CUR: current

VOL: voltage

TEMP: temperature

COM: communication

PROF: device profile

RES: not used, always "0"

MAN: manufacturer-specific

Manufacturer Device Name 0x1008

Name	Manufacturer Device Name
Index	0x1008
Object Code	VARIABLE
No. of Elements	0
Data Type	VISIBLE_STRING

Access	read only
PDO Mapping	No
Units	-
Value Range	Fix
Default Value	FIO AI4AO4

Subindex 0 of this object contains the string length. Subindex 1 contains each of the characters. The character string has no terminating zero.

Manufacturer Hardware Version 0x1009

Name	Manufacturer Hardware Version
Index	0x1009
Object Code	VARIABLE
No. of Elements	0
Data Type	VISIBLE_STRING

Access	read only
PDO Mapping	No
Units	-
Value Range	Fix
Default Value	1.00

Subindex 0 of this object contains the string length. Subindex 1 contains each of the characters. The character string has no terminating zero.

Manufacturer Software Version 0x100A

Name	Manufacturer Software Version
Index	0x100A
Object Code	VARIABLE
No. of Elements	0
Data Type	VISIBLE_STRING

Access	read only
PDO Mapping	No
Value Range	Fix
Default Value	1.00

Identity object 0x1018

Name	Identity Object
Index	0x1018
Object Code	RECORD
No. of Elements	0
Data Type	IDENTITY

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	UNSIGNED8
Access	read only
PDO Mapping	No
Default Value	4

Name	Vendor ID
Subindex	0x01
Data Type	UNSIGNED32
Access	read only
PDO Mapping	No
Default Value	0x0048554B

Name	Product Code
Subindex	0x02
Data Type	UNSIGNED32
Access	read only
PDO Mapping	No
Default Value	0x0002EF68h

Name	Revision Number
Subindex	0x03
Data Type	UNSIGNED32
Access	Read only
PDO Mapping	No
Default Value	

Name	Serial Number
Subindex	0x04
Data Type	UNSIGNED32
Access	Read only
PDO Mapping	No
Default Value	

The object contains details of the manufacturer, the product code and the revision and serial numbers.

Error Settings 0x10F1

Name	Error Settings
Index	0x10F1
Object Code	RECORD
No. of Elements	3
Data Type	

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	UNSIGNED8
Access	read only
PDO Mapping	No
Default Value	2

Name	Local Error Reaction
Subindex	0x01
Data Type	UNSIGNED32
Access	read only
PDO Mapping	No
Default Value	1

Name	Sync Error Counter Limit
Subindex	0x02
Data Type	UNSIGNED16
Access	read only
PDO Mapping	No
Default Value	4

not used

Mapping 0x1600 (Device Control)

Name	Drive Control
Index	0x1600
Object Code	RECORD
No. of Elements	9
Data Type	PDO_MAPPING

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	UNSIGNED8
Access	read write
PDO Mapping	No
Default Value	1

Name	1st Object To Be Mapped
Subindex	0x01
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x2201 00 10

Name	2nd Object To Be Mapped
Subindex	0x02
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Name	3rd Object To Be Mapped
Subindex	0x03
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Name	4th Object To Be Mapped
Subindex	0x04
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x60600008

Name	5th Object To Be Mapped
Subindex	0x05
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Name	6th Object To Be Mapped
Subindex	0x06
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Name	7th Object To Be Mapped
Subindex	0x07
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Name	8th Object To Be Mapped
Subindex	0x08
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Every subindex (1-8) describes a mapped object each. A mapping entry contains four bytes which are made up as follows:

Index[16]	bits 31..16	index of object to be mapped
SubIndex[8]	bits 15..8	subindex of object to be mapped
Length[8]	bits 7..0	length of object to be mapped

Mapping 0x1601 (AO Field Value Physical)

Name	AO Field Value Physical
Index	0x1601
Object Code	RECORD
No. of Elements	9
Data Type	PDO_MAPPING
Exclude	0x1602, 0x1603

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	UNSIGNED8
Access	read only
PDO Mapping	No
Default Value	0x04

Name	1st Object To Be Mapped
Subindex	0x01
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x6330 01 20

Name	2nd Object To Be Mapped
Subindex	0x02
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x6330 02 20

Name	3rd Object To Be Mapped
Subindex	0x03
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x6330 03 20

Name	4th Object To Be Mapped
Subindex	0x04
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x6330 04 20

Name	5th Object To Be Mapped
Subindex	0x05
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Name	6th Object To Be Mapped
Subindex	0x06
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Name	7th Object To Be Mapped
Subindex	0x07
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Name	8th Object To Be Mapped
Subindex	0x08
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Every subindex (1-8) describes a mapped object each. A mapping entry contains four bytes which are made up as follows:

Index[16]	bits 31..16	index of object to be mapped
SubIndex[8]	bits 15..8	subindex of object to be mapped
Length[8]	bits 7..0	length of object to be mapped

Mapping 0x1602 (AO Field Value Increments)

Name	AO Field Value Increments
Index	0x1602
Object Code	RECORD
No. of Elements	9
Data Type	PDO_MAPPING
Exclude	0x1601, 0x1603

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	UNSIGNED8
Access	read only
PDO Mapping	No
Default Value	0x04

Name	1st Object To Be Mapped
Subindex	0x01
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x7330 01 10

Name	2nd Object To Be Mapped
Subindex	0x02
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x7330 02 10

Name	3rd Object To Be Mapped
Subindex	0x03
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x7330 03 10

Name	4th Object To Be Mapped
Subindex	0x04
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x7330 04 10

Name	5th Object To Be Mapped
Subindex	0x05
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Name	6th Object To Be Mapped
Subindex	0x06
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Name	7th Object To Be Mapped
Subindex	0x07
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Name	8th Object To Be Mapped
Subindex	0x08
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Every subindex (1-8) describes a mapped object each. A mapping entry contains four bytes which are made up as follows:

Index[16]	bits 31..16	index of object to be mapped
SubIndex[8]	bits 15..8	subindex of object to be mapped
Length[8]	bits 7..0	length of object to be mapped

Mapping 0x1603 (AO Process Value)

Name	AO Process Value
Index	0x1603
Object Code	RECORD
No. of Elements	9
Data Type	PDO_MAPPING
Exclude	0x1601, 0x1602

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	UNSIGNED8
Access	read only
PDO Mapping	No
Default Value	04

Name	1st Object To Be Mapped
Subindex	0x01
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x6300 01 20

Name	2nd Object To Be Mapped
Subindex	0x02
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x6300 02 20

Name	3rd Object To Be Mapped
Subindex	0x03
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x6300 03 20

Name	4th Object To Be Mapped
Subindex	0x04
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x6300 04 20

Name	5th Object To Be Mapped
Subindex	0x05
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Name	6th Object To Be Mapped
Subindex	0x06
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Name	7th Object To Be Mapped
Subindex	0x07
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Name	8th Object To Be Mapped
Subindex	0x08
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Every subindex (1-8) describes a mapped object each. A mapping entry contains four bytes which are made up as follows:

Index[16]	bits 31..16	index of object to be mapped
SubIndex[8]	bits 15..8	subindex of object to be mapped
Length[8]	bits 7..0	length of object to be mapped

Mapping 0x1A00 (Error Field)

Name	Error Field
Index	0x1A00
Object Code	RECORD
No. of Elements	9
Data Type	PDO_MAPPING

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	UNSIGNED8
Access	read only
PDO Mapping	No
Default Value	0x01

Name	1st Object To Be Mapped
Subindex	0x01
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x213F 00 10

Name	2nd Object To Be Mapped
Subindex	0x02
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Name	3rd Object To Be Mapped
Subindex	0x03
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Name	4th Object To Be Mapped
Subindex	0x04
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Name	5th Object To Be Mapped
Subindex	0x05
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Name	6th Object To Be Mapped
Subindex	0x06
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Name	7th Object To Be Mapped
Subindex	0x07
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Name	8th Object To Be Mapped
Subindex	0x08
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Every subindex (1-8) describes a mapped object each. A mapping entry contains four bytes which are made up as follows:

Index[16]	bits 31..16	index of object to be mapped
SubIndex[8]	bits 15..8	subindex of object to be mapped
Length[8]	bits 7..0	length of object to be mapped

Mapping 0x1A01 (AI Field Value Physical)

Name	AI Field Value Physical
Index	0x1A01
Object Code	RECORD
No. of Elements	9
Data Type	PDO_MAPPING

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	UNSIGNED8
Access	read only
PDO Mapping	No
Default Value	0x04

Name	1st Object To Be Mapped
Subindex	0x01
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x6100 01 20

Name	2nd Object To Be Mapped
Subindex	0x02
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x6100 02 20

Name	3rd Object To Be Mapped
Subindex	0x03
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x6100 03 20

Name	4th Object To Be Mapped
Subindex	0x04
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x6100 04 20

Name	5th Object To Be Mapped
Subindex	0x05
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Name	6th Object To Be Mapped
Subindex	0x06
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Name	7th Object To Be Mapped
Subindex	0x07
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Name	8th Object To Be Mapped
Subindex	0x08
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Every subindex (1-8) describes a mapped object each. A mapping entry contains four bytes which are made up as follows:

Index[16]	bits 31..16	index of object to be mapped
SubIndex[8]	bits 15..8	subindex of object to be mapped
Length[8]	bits 7..0	length of object to be mapped

Mapping 0x1A02 (AI Field Value Increments)

Name	AI Field Value Increments
Index	0x1A02
Object Code	RECORD
No. of Elements	9
Data Type	PDO_MAPPING

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	UNSIGNED8
Access	read only
PDO Mapping	No
Default Value	0x04

Name	1st Object To Be Mapped
Subindex	0x01
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x7100 01 20

Name	2nd Object To Be Mapped
Subindex	0x02
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x7100 02 20

Name	3rd Object To Be Mapped
Subindex	0x03
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x7100 03 20

Name	4th Object To Be Mapped
Subindex	0x04
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x7100 04 20

Name	5th Object To Be Mapped
Subindex	0x05
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Name	6th Object To Be Mapped
Subindex	0x06
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Name	7th Object To Be Mapped
Subindex	0x07
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Name	8th Object To Be Mapped
Subindex	0x08
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Every subindex (1-8) describes a mapped object each. A mapping entry contains four bytes which are made up as follows:

Index[16]	bits 31..16	index of object to be mapped
SubIndex[8]	bits 15..8	subindex of object to be mapped
Length[8]	bits 7..0	length of object to be mapped

Mapping 0x1A03 (AI Process Value)

Name	AI Process Value
Index	0x1A03
Object Code	RECORD
No. of Elements	9
Data Type	PDO_MAPPING

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	UNSIGNED8
Access	read only
PDO Mapping	No
Default Value	0x04

Name	1st Object To Be Mapped
Subindex	0x01
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x6130 01 20

Name	2nd Object To Be Mapped
Subindex	0x02
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x6130 02 20

Name	3rd Object To Be Mapped
Subindex	0x03
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x6130 03 20

Name	4th Object To Be Mapped
Subindex	0x04
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x6130 04 20

Name	5th Object To Be Mapped
Subindex	0x05
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Name	6th Object To Be Mapped
Subindex	0x06
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Name	7th Object To Be Mapped
Subindex	0x07
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Name	8th Object To Be Mapped
Subindex	0x08
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Every subindex (1-8) describes a mapped object each. A mapping entry contains four bytes which are made up as follows:

Index[16]	bits 31..16	index of object to be mapped
SubIndex[8]	bits 15..8	subindex of object to be mapped
Length[8]	bits 7..0	length of object to be mapped

Mapping 0x1A04 (Oversample FV AI1)

Name	Oversample FV AI1
Index	0x1A04
Object Code	RECORD
No. of Elements	9
Data Type	PDO_MAPPING

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	UNSIGNED8
Access	read only
PDO Mapping	No
Default Value	0x05

Name	1st Object To Be Mapped
Subindex	0x01
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x2101 01 10

Name	2nd Object To Be Mapped
Subindex	0x02
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x2101 02 10

Name	3rd Object To Be Mapped
Subindex	0x03
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x2101 03 10

Name	4th Object To Be Mapped
Subindex	0x04
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x2101 04 10

Name	5th Object To Be Mapped
Subindex	0x05
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	2101 05 10h

Name	6th Object To Be Mapped
Subindex	0x06
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Name	7th Object To Be Mapped
Subindex	0x07
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Name	8th Object To Be Mapped
Subindex	0x08
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Every subindex (1-8) describes a mapped object each. A mapping entry contains four bytes which are made up as follows:

Index[16]	bits 31..16	index of object to be mapped
SubIndex[8]	bits 15..8	subindex of object to be mapped
Length[8]	bits 7..0	length of object to be mapped

Mapping 0x1A05 (Oversample FV AI2)

Name	Oversample FV AI2
Index	0x1A05
Object Code	RECORD
No. of Elements	9
Data Type	PDO_MAPPING

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	UNSIGNED8
Access	read only
PDO Mapping	No
Default Value	0x05

Name	1st Object To Be Mapped
Subindex	0x01
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x2102 01 10

Name	2nd Object To Be Mapped
Subindex	0x02
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x2102 02 10

Name	3rd Object To Be Mapped
Subindex	0x03
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x2102 03 10

Name	4th Object To Be Mapped
Subindex	0x04
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x2102 04 10

Name	5th Object To Be Mapped
Subindex	0x05
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	2102 05 10h

Name	6th Object To Be Mapped
Subindex	0x06
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Name	7th Object To Be Mapped
Subindex	0x07
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Name	8th Object To Be Mapped
Subindex	0x08
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Every subindex (1-8) describes a mapped object each. A mapping entry contains four bytes which are made up as follows:

Index[16]	bits 31..16	index of object to be mapped
SubIndex[8]	bits 15..8	subindex of object to be mapped
Length[8]	bits 7..0	length of object to be mapped

Mapping 0x1A06 (Oversample FV AI3)

Name	Oversample FV AI3
Index	0x1A06
Object Code	RECORD
No. of Elements	9
Data Type	PDO_MAPPING

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	UNSIGNED8
Access	read only
PDO Mapping	No
Default Value	0x05

Name	1st Object To Be Mapped
Subindex	0x01
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x2103 01 10

Name	2nd Object To Be Mapped
Subindex	0x02
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x2103 02 10

Name	3rd Object To Be Mapped
Subindex	0x03
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x2103 03 10

Name	4th Object To Be Mapped
Subindex	0x04
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x2103 04 10

Name	5th Object To Be Mapped
Subindex	0x05
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x2103 05 10

Name	6th Object To Be Mapped
Subindex	0x06
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Name	7th Object To Be Mapped
Subindex	0x07
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Name	8th Object To Be Mapped
Subindex	0x08
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Every subindex (1-8) describes a mapped object each. A mapping entry contains four bytes which are made up as follows:

Index[16]	bits 31..16	index of object to be mapped
SubIndex[8]	bits 15..8	subindex of object to be mapped
Length[8]	bits 7..0	length of object to be mapped

Mapping 0x1A07 (Oversample FV AI4)

Name	Oversample FV AI4
Index	0x1A07
Object Code	RECORD
No. of Elements	9
Data Type	PDO_MAPPING

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	UNSIGNED8
Access	read only
PDO Mapping	No
Default Value	0x05

Name	1st Object To Be Mapped
Subindex	0x01
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x2104 01 10

Name	2nd Object To Be Mapped
Subindex	0x02
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x2104 02 10

Name	3rd Object To Be Mapped
Subindex	0x03
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x2104 03 10

Name	4th Object To Be Mapped
Subindex	0x04
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x2104 04 10

Name	5th Object To Be Mapped
Subindex	0x05
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x2104 05 10

Name	6th Object To Be Mapped
Subindex	0x06
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Name	7th Object To Be Mapped
Subindex	0x07
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Name	8th Object To Be Mapped
Subindex	0x08
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Every subindex (1-8) describes a mapped object each. A mapping entry contains four bytes which are made up as follows:

Index[16]	bits 31..16	index of object to be mapped
SubIndex[8]	bits 15..8	subindex of object to be mapped
Length[8]	bits 7..0	length of object to be mapped

Mapping 0x1A08 (Oversample PV AI1)

Name	Oversample PV AI1
Index	0x1A08
Object Code	RECORD
No. of Elements	9
Data Type	PDO_MAPPING

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	UNSIGNED8
Access	read only
PDO Mapping	No
Default Value	0x05

Name	1st Object To Be Mapped
Subindex	0x01
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x2131 01 20

Name	2nd Object To Be Mapped
Subindex	0x02
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x2131 02 20

Name	3rd Object To Be Mapped
Subindex	0x03
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x2101 03 10

Name	4th Object To Be Mapped
Subindex	0x04
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x2131 04 20

Name	5th Object To Be Mapped
Subindex	0x05
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x2131 05 20

Name	6th Object To Be Mapped
Subindex	0x06
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Name	7th Object To Be Mapped
Subindex	0x07
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Name	8th Object To Be Mapped
Subindex	0x08
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Every subindex (1-8) describes a mapped object each. A mapping entry contains four bytes which are made up as follows:

Index[16]	bits 31..16	index of object to be mapped
SubIndex[8]	bits 15..8	subindex of object to be mapped
Length[8]	bits 7..0	length of object to be mapped

Mapping 0x1A09 (Oversample PV AI2)

Name	Oversample PV AI2
Index	0x1A09
Object Code	RECORD
No. of Elements	9
Data Type	PDO_MAPPING

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	UNSIGNED8
Access	read only
PDO Mapping	No
Default Value	0x05

Name	1st Object To Be Mapped
Subindex	0x01
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x2132 01 20

Name	2nd Object To Be Mapped
Subindex	0x02
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x2132 02 20

Name	3rd Object To Be Mapped
Subindex	0x03
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x2132 03 20

Name	4th Object To Be Mapped
Subindex	0x04
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x2132 04 20

Name	5th Object To Be Mapped
Subindex	0x05
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x2132 05 20

Name	6th Object To Be Mapped
Subindex	0x06
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Name	7th Object To Be Mapped
Subindex	0x07
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Name	8th Object To Be Mapped
Subindex	0x08
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Every subindex (1-8) describes a mapped object each. A mapping entry contains four bytes which are made up as follows:

Index[16]	bits 31..16	index of object to be mapped
SubIndex[8]	bits 15..8	subindex of object to be mapped
Length[8]	bits 7..0	length of object to be mapped

Mapping 0x1A0A (Oversample PV AI3)

Name	Oversample PV AI3
Index	0x1A0A
Object Code	RECORD
No. of Elements	9
Data Type	PDO_MAPPING

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	UNSIGNED8
Access	read only
PDO Mapping	No
Default Value	0x05

Name	1st Object To Be Mapped
Subindex	0x01
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x2133 01 20

Name	2nd Object To Be Mapped
Subindex	0x02
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x2133 02 20

Name	3rd Object To Be Mapped
Subindex	0x03
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x2133 03 20

Name	4th Object To Be Mapped
Subindex	0x04
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x2133 04 20

Name	5th Object To Be Mapped
Subindex	0x05
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x2133 05 20

Name	6th Object To Be Mapped
Subindex	0x06
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Name	7th Object To Be Mapped
Subindex	0x07
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Name	8th Object To Be Mapped
Subindex	0x08
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Every subindex (1-8) describes a mapped object each. A mapping entry contains four bytes which are made up as follows:

Index[16]	bits 31..16	index of object to be mapped
SubIndex[8]	bits 15..8	subindex of object to be mapped
Length[8]	bits 7..0	length of object to be mapped

Mapping 0x1A0B (Oversample PV AI4)

Name	Oversample PV AI4
Index	0x1A0B
Object Code	RECORD
No. of Elements	9
Data Type	PDO_MAPPING

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	UNSIGNED8
Access	read only
PDO Mapping	No
Default Value	0x05

Name	1st Object To Be Mapped
Subindex	0x01
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x2134 01 20

Name	2nd Object To Be Mapped
Subindex	0x02
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x2134 02 20

Name	3rd Object To Be Mapped
Subindex	0x03
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x2134 03 20

Name	4th Object To Be Mapped
Subindex	0x04
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x2134 04 20

Name	5th Object To Be Mapped
Subindex	0x05
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	0x2134 05 20

Name	6th Object To Be Mapped
Subindex	0x06
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Name	7th Object To Be Mapped
Subindex	0x07
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Name	8th Object To Be Mapped
Subindex	0x08
Data Type	UNSIGNED32
Access	read write
PDO Mapping	No
Default Value	

Every subindex (1-8) describes a mapped object each. A mapping entry contains four bytes which are made up as follows:

Index[16]	bits 31..16	index of object to be mapped
SubIndex[8]	bits 15..8	subindex of object to be mapped
Length[8]	bits 7..0	length of object to be mapped

AI Channel Control 0x2001

Name	AI Channel Control
Index	0x2001
Object Code	ARRAY
No. of Elements	5
Data Type	UINT8

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	UINT8
Access	read only
PDO Mapping	No
Default Value	0x04

Name	AI Channel Control 1
Subindex	0x01
Data Type	UINT8
Access	read write
PDO Mapping	yes, Rx-PDO
Default Value	

Name	AI Channel Control 2
Subindex	0x02
Data Type	UINT8
Access	read write
PDO Mapping	Yes, RX-PDO
Default Value	

Name	AI Channel Control 3
Subindex	0x03
Data Type	UINT8
Access	read write
PDO Mapping	Yes, RX-PDO
Default Value	

Name	AI Channel Control 4
Subindex	0x04
Data Type	UINT8
Access	read write
PDO Mapping	Yes, RX-PDO
Default Value	

7	6	5	4	3	2	1	0
					COMP	SCAL	ACT

ACT:

0 = input inactive

1 = input active

SCAL:

0 = scale input values by factor and offset

1 = scale input values by control points

COMP:

0 = comparator inactive

1 = comparator active

AI Channel Status 0x2002

Name	AI Channel State
Index	0x2002
Object Code	ARRAY
No. of Elements	5
Data Type	UINT8

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	UINT8
Access	read only
PDO Mapping	No
Default Value	0x04

Name	AI Channel Status 1
Subindex	0x01
Data Type	UINT8
Access	read only
PDO Mapping	yes, TX-PDO
Default Value	

Name	AI Channel Status 2
Subindex	0x02
Data Type	UINT8
Access	read only
PDO Mapping	yes, TX-PDO
Default Value	

Name	AI Channel Status 3
Subindex	0x03
Data Type	UINT8
Access	read only
PDO Mapping	yes, TX-PDO
Default Value	

Name	AI Channel Status 4
Subindex	0x04
Data Type	UINT8
Access	read only
PDO Mapping	yes, TX-PDO
Default Value	

Channel status:

7	6	5	4	3	2	1	0
						UpLim	LoLim

LoLim (lower limit) or UpLim (upper limit)

0 = limit not exceeded

1 = limit exceeded

Error Log 0x2003

Name	Error Log
Index	0x2003
Object Code	RECORD
No. of Elements	9
Data Type	UNSIGNED32

Name	Number of Errors
Subindex	00h
Data Type	UNSIGNED8
Access	read write
PDO Mapping	No
Default Value	0x00

Name	Standard Error Field
Subindex	0x01 .. 0x08
Data Type	UNSIGNED32
Access	read only
PDO Mapping	No
Default Value	

A new error occurring is entered in subindex 1. Previous entries in subindices 1 to 7 are moved one place back. The error in subindex 7 is removed.

Check the object with subindex 0 to find the number of previous errors. Setting this object to "0" starts a new count.

The object contains the error numbers retrieved from object Error Code 213Fh

Sample Count 0x2100

Name	Sample Count
Index	0x2100
Object Code	VARIABLE
No. of Elements	0
Data Type	UNSIGNED32

Access	read only
PDO Mapping	yes, TX-PDO
Value Range	
Default Value	0x00

Number of samples since last reset / restart

AI1 Oversample Data FV 0x2101

Name	AI1 Oversample Data FV
Index	0x2101
Object Code	ARRAY
No. of Elements	6

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	INT16
Access	read only
PDO Mapping	NO
Default Value	0x05

Name	AI1 Sample N+0 .. N+4
Subindex	0x01 .. 0x05
Data Type	INT16
Access	read only
PDO Mapping	yes, TX-PDO
Default Value	

Oversampling input values AI1

AI2 Oversample Data FV 0x2102

Name	AI2 Oversample Data FV
Index	0x2102
Object Code	ARRAY
No. of Elements	6

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	INT16
Access	read only
PDO Mapping	NO
Default Value	0x05

Name	AI2 Sample N+0 .. N+4
Subindex	0x01 .. 0x05
Data Type	INT16
Access	read only
PDO Mapping	yes, TX-PDO
Default Value	

Oversampling input values AI2

AI3 Oversample Data FV 0x2103

Name	AI3 Oversample Data FV
Index	0x2103
Object Code	ARRAY
No. of Elements	6

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	INT16
Access	read only
PDO Mapping	NO
Default Value	0x05

Name	AI3 Sample N+0 .. N+4
Subindex	0x01 .. 0x05
Data Type	INT16
Access	read only
PDO Mapping	yes, TX-PDO
Default Value	

Oversampling input values AI3

AI4 Oversample Data FV 0x2104

Name	AI4 Oversample Data FV
Index	0x2104
Object Code	ARRAY
No. of Elements	6

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	INT16
Access	read only
PDO Mapping	NO
Default Value	0x05

Name	AI4 Sample N+0 .. N+4
Subindex	0x01 .. 0x05
Data Type	INT16
Access	read only
PDO Mapping	yes, TX-PDO
Default Value	

Oversampling input values AI4

AI Input Calibration Gain 0x2125

Name	AI Input Calibration Gain
Index	0x2125
Object Code	RECORD
No. of Elements	5

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	REAL32
Access	read only
PDO Mapping	No
Default Value	0x04

Name	AI Input Calibration Gain 1
Subindex	0x01
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	1.0

Name	AI Input Calibration Gain 2
Subindex	0x02
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	1.0

Name	AI Input Calibration Gain 3
Subindex	0x03
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	1.0

Name	AI Input Calibration Gain 4
Subindex	0x04
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	1.0

Channel-specific calibration factor for correcting the gain error

AI1 Oversample Data PV 0x2131

Name	AI1 Oversample Data PV
Index	0x2131h
Object Code	ARRAY
No. of Elements	6

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	REAL32
Access	read only
PDO Mapping	NO
Default Value	0x05

Name	AI1 Sample N+0 .. N+4
Subindex	0x01 .. 0x05
Data Type	REAL32
Access	read only
PDO Mapping	yes, TX-PDO
Default Value	

Oversampling input values AI1

AI2 Oversample Data PV 0x2132

Name	AI2 Oversample Data PV
Index	0x2132
Object Code	ARRAY
No. of Elements	6

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	REAL32
Access	read only
PDO Mapping	NO
Default Value	0x05

Name	AI2 Sample N+0 .. N+4
Subindex	0x01 .. 0x05
Data Type	REAL32
Access	read only
PDO Mapping	yes, TX-PDO
Default Value	

Oversampling input values AI2

AI3 Oversample Data PV 0x2133

Name	AI3 Oversample Data PV
Index	0x2133
Object Code	ARRAY
No. of Elements	6

Name	Highest Sub-index Supported
Subindex	00h
Data Type	REAL32
Access	read only
PDO Mapping	NO
Default Value	0x05

Name	AI3 Sample N+0 .. N+4
Subindex	0x01 .. 0x05
Data Type	REAL32
Access	read only
PDO Mapping	yes, TX-PDO
Default Value	

Oversampling input values AI3

AI4 Oversample Data PV 0x2134

Name	AI4 Oversample Data PV
Index	0x2134
Object Code	ARRAY
No. of Elements	6

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	REAL32
Access	read only
PDO Mapping	NO
Default Value	0x05

Name	AI4 Sample N+0 .. N+4
Subindex	0x01 .. 0x05
Data Type	REAL32
Access	read only
PDO Mapping	yes, TX-PDO
Default Value	

Oversampling input values AI4

Error Code 0x213F

Name	Error Code
Index	0x213F
Object Code	VARIABLE
No. of Elements	0
Data Type	UNSIGNED16

Access	read only
PDO Mapping	yes, TX-PDO
Value Range	
Default Value	00h

2320h AO0 temperature too high
2321h AO1 temperature too high
2322h AO2 temperature too high
2323h AO3 temperature too high

2330h AO0 overvoltage or broken wire
2331h AO1 overvoltage or broken wire
2332h AO2 overvoltage or broken wire
2333h AO3 overvoltage or broken wire

3120h low module voltage

5100h AI0 input value out of set limits
510x01h AI1 input value out of set limits
510x02 AI2 input value out of set limits
510x03 AI3 input value out of set limits

5300h AI0 sensor error (current smaller than 4mA)
530x01h AI1 sensor error (current smaller than 4mA)
530x02 AI2 sensor error (current smaller than 4mA)
530x03 AI3 sensor error (current smaller than 4mA)

6010h watchdog

8000h communication error

Device Control 2201

Name	Device Control
Index	2201
Object Code	VARIABLE
No. of Elements	0
Data Type	UNSIGNED16

Access	read write
PDO Mapping	Yes, RX-PDO
Value Range	
Default Value	00h

7	6	5	4	3	2	1	0
							RES

RES:

0 = do nothing

1 = reset device

Device Status 0x2202

Name	Device Status
Index	0x2202
Object Code	VARIABLE
No. of Elements	0
Data Type	UNSIGNED16

Access	read only
PDO Mapping	yes, TX-PDO
Value Range	
Default Value	0x00

Not used

AI Input FV 0x6100

Name	AI Input FV
Index	0x6100
Object Code	ARRAY
No. of Elements	5
Data Type	REAL32

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	REAL32
Access	read only
PDO Mapping	No
Default Value	0x04

Name	AI Input FV 1
Subindex	0x01
Data Type	REAL32
Access	read only
PDO Mapping	yes, TX-PDO
Default Value	

Name	AI Input FV 2
Subindex	0x02
Data Type	REAL32
Access	read only
PDO Mapping	yes, TX-PDO
Default Value	

Name	AI Input FV 3
Subindex	0x03
Data Type	REAL32
Access	read only
PDO Mapping	yes, TX-PDO
Default Value	

Name	AI Input FV 4
Subindex	0x04
Data Type	REAL32
Access	read only
PDO Mapping	yes, TX-PDO
Default Value	

Analogue input values as measured Real variable or, if oversampling is active, average of sampled input values.

AI Sensor Type 0x6110

Name	AI Sensor Type
Index	0x6110
Object Code	RECORD
No. of Elements	5

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	UINT16
Access	read only
PDO Mapping	No
Default Value	0x04

Name	AI Sensor Type 1
Subindex	0x01
Data Type	UINT16
Access	read write
PDO Mapping	No
Default Value	

Name	AI Sensor Type 2
Subindex	0x02
Data Type	UINT16
Access	read write
PDO Mapping	No
Default Value	

Name	AI Sensor Type 3
Subindex	0x03
Data Type	UINT16
Access	read write
PDO Mapping	No
Default Value	

Name	AI Sensor Type 4
Subindex	0x04
Data Type	UINT16
Access	read write
PDO Mapping	No
Default Value	

Channel-specific setting of the attached sensor:

42 = 0…10 V (default)

52 = 0…20 mA

51 = 4…20 mA

AI Input Scaling 1 FV 0x6120

Name	AI Input Scaling 1 FV
Index	0x6120
Object Code	RECORD
No. of Elements	5

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	REAL32
Access	read only
PDO Mapping	No
Default Value	0x04

Name	AI Input Scaling 1 FV 1
Subindex	0x01
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	

Name	AI Input Scaling 1 FV 2
Subindex	0x02
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	

Name	AI Input Scaling 1 FV 3
Subindex	0x03
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	

Name	AI Input Scaling 1 FV 4
Subindex	0x04
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	

AI Input Scaling 1 PV 0x6121

Name	AI Input Scaling 1 PV
Index	0x6121
Object Code	RECORD
No. of Elements	5

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	REAL32
Access	read only
PDO Mapping	No
Default Value	0x04

Name	AI Input Scaling 1 PV 1
Subindex	0x01
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	

Name	AI Input Scaling 1 PV 2
Subindex	0x02
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	

Name	AI Input Scaling 1 PV 3
Subindex	0x03
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	

Name	AI Input Scaling 1 PV 4
Subindex	0x04
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	

AI Input Scaling 2 FV 0x6122

Name	AI Input Scaling 2 FV
Index	0x6122
Object Code	RECORD
No. of Elements	5

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	REAL32
Access	read only
PDO Mapping	No
Default Value	0x04

Name	AI Input Scaling 2 FV 1
Subindex	0x01
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	

Name	AI Input Scaling 2 FV 2
Subindex	0x02
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	

Name	AI Input Scaling 2 FV 3
Subindex	0x03
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	

Name	AI Input Scaling 2 FV 4
Subindex	0x04
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	

AI Input Scaling 2 PV 0x6123

Name	AI Input Scaling 2 PV
Index	0x6123
Object Code	RECORD
No. of Elements	5

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	REAL32
Access	read only
PDO Mapping	No
Default Value	0x04

Name	AI Input Scaling 2 PV 1
Subindex	0x01
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	

Name	AI Input Scaling 2 PV 2
Subindex	0x02
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	

Name	AI Input Scaling 2 PV 3
Subindex	0x03
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	

Name	AI Input Scaling 2 PV 4
Subindex	0x04
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	

AI Input Offset 0x6124

Name	AI Input Offset
Index	0x6124
Object Code	RECORD
No. of Elements	5

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	REAL32
Access	read only
PDO Mapping	No
Default Value	0x04

Name	AI Input Offset 1
Subindex	0x01
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	

Name	AI Input Offset 2
Subindex	0x02
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	

Name	AI Input Offset 3
Subindex	0x03
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	

Name	AI Input Offset 4
Subindex	0x04
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	

Channel-specific offset, in [V] or [mA]

AI Scaling Factor 0x6126

Name	AI Scaling Factor
Index	0x6126
Object Code	RECORD
No. of Elements	5

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	REAL32
Access	read only
PDO Mapping	No
Default Value	0x04

Name	AI Scaling Factor 1
Subindex	0x01
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	

Name	AI Scaling Factor 2
Subindex	0x02
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	

Name	AI Scaling Factor 3
Subindex	0x03
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	

Name	AI Scaling Factor 4
Subindex	0x04
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	

Scaling factor [process value / field value]

AI Scaling Offset 0x6127h

Name	AI Scaling Offset
Index	0x6127
Object Code	RECORD
No. of Elements	5

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	REAL32
Access	read only
PDO Mapping	No
Default Value	0x04

Name	AI Scaling Offset 1
Subindex	0x01
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	

Name	AI Scaling Offset 2
Subindex	0x02
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	

Name	AI Scaling Offset 3
Subindex	0x03
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	

Name	AI Scaling Offset 4
Subindex	0x04
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	

Scaling offset [process value]

AI Input PV 0x6130

Name	AI Input PV
Index	0x6130
Object Code	ARRAY
No. of Elements	5
Data Type	REAL32

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	REAL32
Access	read only
PDO Mapping	No
Default Value	0x04

Name	AI Input PV 1
Subindex	0x01
Data Type	REAL32
Access	read only
PDO Mapping	yes, TX-PDO
Default Value	

Name	AI Input PV 2
Subindex	0x02
Data Type	REAL32
Access	read only
PDO Mapping	yes, TX-PDO
Default Value	

Name	AI Input PV 3
Subindex	0x03
Data Type	REAL32
Access	read only
PDO Mapping	yes, TX-PDO
Default Value	

Name	AI Input PV 4
Subindex	0x04
Data Type	REAL32
Access	read only
PDO Mapping	yes, TX-PDO
Default Value	

Analogue process input values as measured Real quantities, depending on the scaling values.
Average of sampled process input values if oversampling is active.

AI Filter Type 0x61A0

Name	AI Filter Type
Index	0x61A0
Object Code	RECORD
No. of Elements	5

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	UINT8
Access	read only
PDO Mapping	No
Default Value	0x04

Name	AI Filter Type 1
Subindex	0x01
Data Type	ENUM
Access	read write
PDO Mapping	No
Default Value	

Name	AI Filter Type 2
Subindex	0x02
Data Type	ENUM
Access	read write
PDO Mapping	No
Default Value	

Name	AI Filter Type 3
Subindex	0x03
Data Type	ENUM
Access	read write
PDO Mapping	No
Default Value	

Name	AI Filter Type 4
Subindex	0x04
Data Type	ENUM
Access	read write
PDO Mapping	No
Default Value	

Object for activating the input filter.
0 = no filter active
1 = filter PT1

AI Filter Constant 0x61A1

Name	AI Filter Constant
Index	0x61A1
Object Code	RECORD
No. of Elements	5

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	UINT8
Access	read only
PDO Mapping	No
Default Value	0x04

Name	AI Filter Constant 1
Subindex	0x01
Data Type	UINT16
Access	read write
PDO Mapping	No
Default Value	

Name	AI Filter Constant 2
Subindex	0x02
Data Type	UINT16
Access	read write
PDO Mapping	No
Default Value	

Name	AI Filter Constant 3
Subindex	0x03
Data Type	UINT16
Access	read write
PDO Mapping	No
Default Value	

Name	AI Filter Constant 4
Subindex	0x04
Data Type	UINT16
Access	read write
PDO Mapping	No
Default Value	

PT1 filter time, in [ms]

AO Output PV 0x6300

Name	AO Output PV
Index	0x6300
Object Code	ARRAY
No. of Elements	5
Data Type	REAL32

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	REAL32
Access	read only
PDO Mapping	No
Default Value	0x04

Name	AO Output PV 1
Subindex	0x01
Data Type	REAL32
Access	read only
PDO Mapping	yes, TX-PDO
Default Value	

Name	AO Output PV 2
Subindex	0x02
Data Type	REAL32
Access	read only
PDO Mapping	yes, TX-PDO
Default Value	

Name	AO Output PV 3
Subindex	0x03
Data Type	REAL32
Access	read only
PDO Mapping	yes, TX-PDO
Default Value	

Name	AO Output PV 4
Subindex	0x04
Data Type	REAL32
Access	read only
PDO Mapping	yes, TX-PDO
Default Value	

AO Output Type 0x6310

Name	AO Output Type
Index	0x6310
Object Code	RECORD
No. of Elements	5

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	UINT16
Access	read only
PDO Mapping	No
Default Value	0x04

Name	AO Output Type 1
Subindex	0x01
Data Type	UINT16
Access	read write
PDO Mapping	No
Default Value	

Name	AO Output Type 2
Subindex	0x02
Data Type	UINT16
Access	read write
PDO Mapping	No
Default Value	

Name	AO Output Type 3
Subindex	0x03
Data Type	UINT16
Access	read write
PDO Mapping	No
Default Value	

Name	AO Output Type 4
Subindex	0x04
Data Type	UINT16
Access	read write
PDO Mapping	No
Default Value	

Channel-specific configuration of analogue outputs

10 = voltage 0…10V (default)

11 = voltage -10…10V

20 = current 0…20mA

21 = current 4…20mA

AO operating mode 0x6313

Name	AO operating mode
Index	0x6313
Object Code	RECORD
No. of Elements	5

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	UINT16
Access	read only
PDO Mapping	No
Default Value	0x04

Name	AO operating mode 1
Subindex	0x01
Data Type	UINT16
Access	read write
PDO Mapping	No
Default Value	

Name	AO operating mode 2
Subindex	0x02
Data Type	UINT16
Access	read write
PDO Mapping	No
Default Value	

Name	AO operating mode 3
Subindex	0x03
Data Type	UINT16
Access	read write
PDO Mapping	No
Default Value	

Name	AO operating mode 4
Subindex	0x04
Data Type	UINT16
Access	read write
PDO Mapping	No
Default Value	

Channel-specific configuration of the data format needed for the analogue outputs

0 = output not active (default)

1 = output process value

10 = output field value decimal

11 = output field value increments

AO Output Scaling 1 FV 0x6320

Name	AO Output Scaling 1 FV
Index	0x6320
Object Code	RECORD
No. of Elements	5

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	REAL32
Access	read only
PDO Mapping	No
Default Value	0x04

Name	AO Output Scaling 1 FV 1
Subindex	0x01
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	

Name	AO Output Scaling 1 FV 2
Subindex	0x02
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	

Name	AO Output Scaling 1 FV 3
Subindex	0x03
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	

Name	AO Output Scaling 1 FV 4
Subindex	0x04
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	

AO Output Scaling 1 PV 0x6321

Name	AO Output Scaling 1 PV
Index	0x6321
Object Code	RECORD
No. of Elements	5

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	REAL32
Access	read only
PDO Mapping	No
Default Value	0x04

Name	AO Output Scaling 1 PV 1
Subindex	0x01
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	

Name	AO Output Scaling 1 PV 2
Subindex	0x02
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	

Name	AO Output Scaling 1 PV 3
Subindex	0x03
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	

Name	AO Output Scaling 1 PV 4
Subindex	0x04
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	

AO Output Scaling 2 FV 0x6322

Name	AO Output Scaling 2 FV
Index	0x6322
Object Code	RECORD
No. of Elements	5

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	REAL32
Access	read only
PDO Mapping	No
Default Value	0x04

Name	AO Output Scaling 2 FV 1
Subindex	0x01
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	

Name	AO Output Scaling 2 FV 2
Subindex	0x02
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	

Name	AO Output Scaling 2 FV 3
Subindex	0x03
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	

Name	AO Output Scaling 2 FV 4
Subindex	0x04
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	

AO Output Scaling 2 PV 0x6323

Name	AO Output Scaling 2 PV
Index	0x6323
Object Code	RECORD
No. of Elements	5

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	REAL32
Access	read only
PDO Mapping	No
Default Value	0x04

Name	AO Output Scaling 2 PV 1
Subindex	0x01
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	

Name	AO Output Scaling 2 PV 2
Subindex	0x02
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	

Name	AO Output Scaling 2 PV 3
Subindex	0x03
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	

Name	AO Output Scaling 2 PV 4
Subindex	0x04
Data Type	REAL32
Access	read write
PDO Mapping	No
Default Value	

AO Output FV 0x6330

Name	AO Output FV
Index	0x6330
Object Code	ARRAY
No. of Elements	5
Data Type	REAL32

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	REAL32
Access	read only
PDO Mapping	No
Default Value	0x04

Name	AO Output FV 1
Subindex	0x01
Data Type	REAL32
Access	read only
PDO Mapping	yes, TX-PDO
Default Value	

Name	AO Output FV 2
Subindex	0x02
Data Type	REAL32
Access	read only
PDO Mapping	yes, TX-PDO
Default Value	

Name	AO Output FV 3
Subindex	0x03
Data Type	REAL32
Access	read only
PDO Mapping	yes, TX-PDO
Default Value	

Name	AO Output FV 4
Subindex	0x04
Data Type	REAL32
Access	read only
PDO Mapping	yes, TX-PDO
Default Value	

Analogue input values as measured Real variable

AI Input FV 0x7100

Name	AI Input FV
Index	0x7100
Object Code	ARRAY
No. of Elements	5
Data Type	INT16

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	INT16
Access	read only
PDO Mapping	No
Default Value	0x04

Name	AI Input FV 1
Subindex	0x01
Data Type	INT16
Access	read only
PDO Mapping	yes, TX-PDO
Default Value	

Name	AI Input FV 2
Subindex	0x02
Data Type	INT16
Access	read only
PDO Mapping	yes, TX-PDO
Default Value	

Name	AI Input FV 3
Subindex	0x03
Data Type	INT16
Access	read only
PDO Mapping	yes, TX-PDO
Default Value	

Name	AI Input FV 4
Subindex	0x04
Data Type	INT16
Access	read only
PDO Mapping	yes, TX-PDO
Default Value	

Analogue input values as measured Integer variable or, if oversampling is active, average of sampled input values.

AO Output FV 0x7330

Name	AO Output FV
Index	0x7330
Object Code	ARRAY
No. of Elements	5
Data Type	INT16

Name	Highest Sub-index Supported
Subindex	0x00
Data Type	INT16
Access	read only
PDO Mapping	No
Default Value	0x04

Name	AO Output FV 1
Subindex	0x01
Data Type	INT16
Access	read only
PDO Mapping	yes, TX-PDO
Default Value	

Name	AO Output FV 2
Subindex	0x02
Data Type	INT16
Access	read only
PDO Mapping	yes, TX-PDO
Default Value	

Name	AO Output FV 3
Subindex	0x03
Data Type	INT16
Access	read only
PDO Mapping	yes, TX-PDO
Default Value	

Name	AO Output FV 4
Subindex	0x04
Data type	INT16
Access	read only
PDO Mapping	Yes, TX-PDO
Default Value	

Analogue output values as Integer values

2.9.8 Technical Data

Module

EtherCAT slave controller..... ASIC ET1200
E-bus connector ..... 10-pole system plug in side wall
E-bus load..... 150 mA
I/O / power connection..... 36-pin male
Power supply ..... 24 VDC (-15% ... +20%)
Electrical insulation..... 500V E-Bus / power supply
Part no. ..... 694.444.65 (CoE)

Analogue Inputs

Analogue inputs..... 4
Resolution..... 12 bit
Start AD conversion..... synchronised with DC / SM
Oversampling ..... 2..5-fold
Intrinsic error..... ±0.2%
Temperature error ..... ±0.005%/K
Internal resistance ..... < 300Ω
Input filter cutoff frequency ..... 100 kHz

Voltage:
Measuring range 0...10V:
Settling time..... 0→10V: ≤22µs at 2kΩ/<200pF
Measuring error ..... < ±0.5%, typ. < ±0.4% of final value
Conversion time..... 235 µs (if all channels are active)

Current:
Measuring range..... 0…20mA, 4…20mA
Settling time..... 0→16V: ≤25µs at 300Ω/<1mH
Measuring error ..... < ±0.5%, typ. < ±0.4% of final value
Conversion time..... 200 µs (if all channels are active)

Analogue Outputs

Analogue outputs 4
Resolution ..... 16 bit
Output frequency ..... synchronised with SM/DC
Intrinsic error ..... ±0.2%
Temperature error ..... ±0.005%/K
Destruction limit
(external voltages) 15V

Voltage:
Measuring range ..... 0 … 10V, ± 10V
Short circuit protection ..... Yes
Short circuit current ..... max. 30mA
Load resistance ..... min. 1kΩ
Settling time ..... 0→10V: ≤22µs at 2kΩ/<200pF

Current:
Measuring range ..... 0…20mA, 4…20mA, 0…24mA
Load resistance ..... max. 500Ω, max. 1mH (inductive)
Settling time ..... 0→16V: ≤25µs at 300Ω/<1mH

3 Appendix

3.1 Order Data

3.1.1 Modules

Kuhnke FIO AI4-I 12 Bit (CoE) ..... 694 441 51 / 184919
Kuhnke FIO AI4/8-U 13 Bit (CoE) ..... 694 441 52 / 184920
Kuhnke FIO AI8/18-U 13Bit (CoE) ..... 694 441 53 / 184921
Kuhnke FIO AI8-I 12 Bit (CoE) ..... 694 441 54 / 183279
Kuhnke FIO AO4-U/I 16 Bit (CoE) ..... 694 442 52 / 183564
Kuhnke FIO AI4 12 Bit/ AO4 16 Bit (CoE) ..... 694.444.65 / 192357
Kuhnke FIO AI4 Pt/Ni/Thermo 16 Bit (CoE) ..... 694.443.57 / 184894
Kuhnke FIO AI8 Pt/Ni/Thermo 16 Bit (CoE) ..... 694.443.58 / 184895

3.1.2 Accessories

Kuhnke FIO Shield Terminal 2x8mm ..... 694 412 03 / 196445
Kuhnke FIO Shield Terminal 1x14mm ..... 694 412 04 / 196446
Kuhnke FIO Shield Terminal 4x8mm ..... 694 412 05 / 196448
Kuhnke FIO Shield Terminal 2x14mm ..... 694 412 06 / 197524

KENDRION

PRECISION. SAFETY. MOTION.

Kendrion Kuhnke Automation GmbH
Industrial Control Systems

Lütjenburger Str. 101
D-23714 Malente

Tel.: +49 4523 402 0
Fax: +49 4523 402 201

sales-ics@kendrion.com
www.kendrion.com